AYK REGION
YUKON STATE/FED REPORT #2

ARCTIC YUKON KUSKOKWIM AREA

ANADROMOUS FISH INVESTIGATIONS

ANNUAL TECHNICAL REPORT, 1968

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ANADROMOUS FISH PROJECT

Project Title: Arctic-Yukon-Kuskokwim Area Anadromous Fish Investigations

Project No: AFC-7-2

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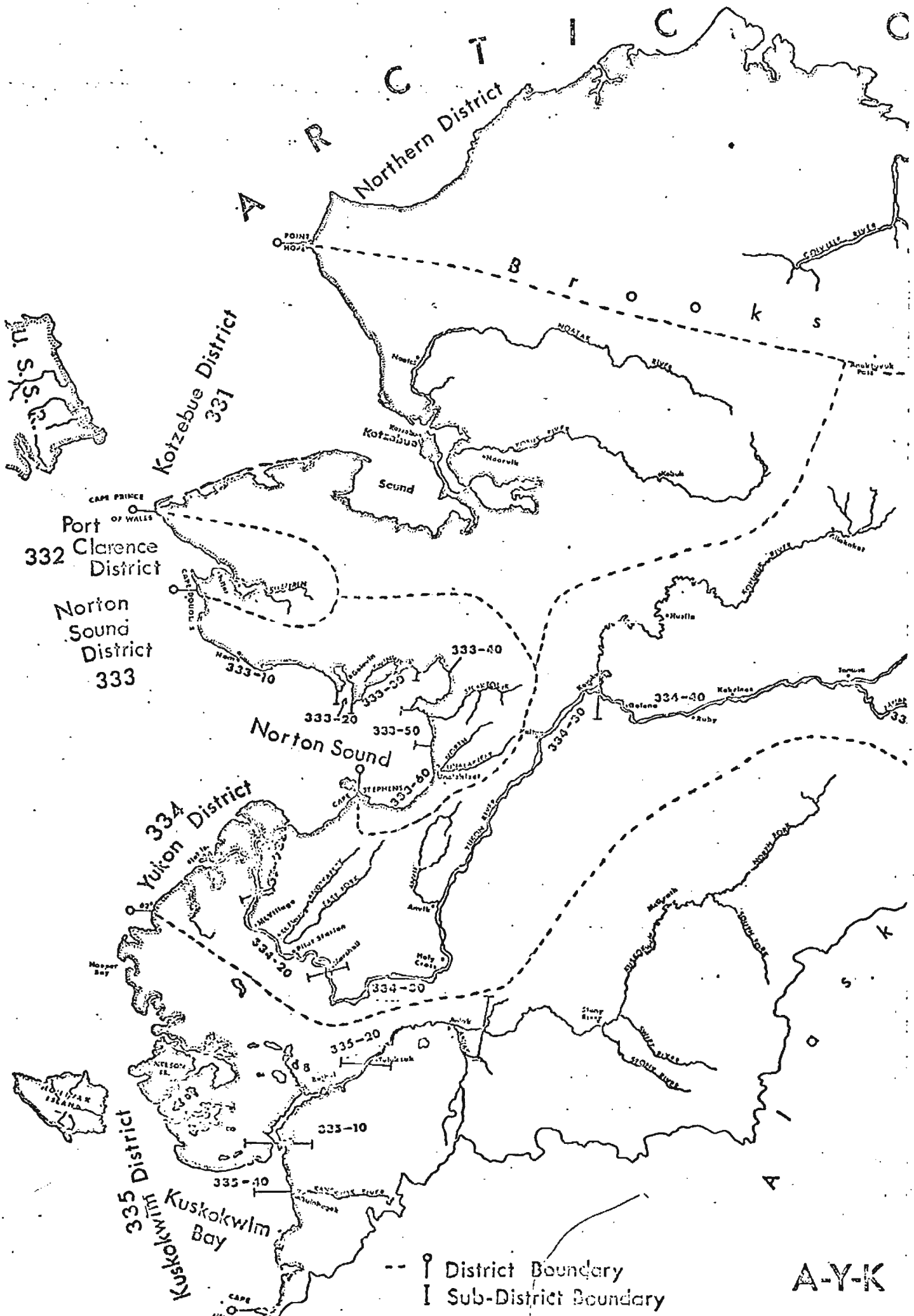
FOREWORD

The Arctic-Yukon-Kuskokwim area, that portion of Alaska north of Bristol Bay and the Alaska Range, is the largest commercial fishery management unit in the State (see Map, Figure 1). This vast region is equal to the combined areas of California, Oregon, Washington, and Idaho: a total of nearly 400,000 square miles. In 1960 the State of Alaska, Department of Fish and Game, became responsible for the management and research of the fishery resources. Prior to 1960, salmon research programs in the A-Y-K area were practically non-existent, although commercial fishing dates back as early as 1913. The majority of the State funds, allocated annually to the A-Y-K area, were utilized mainly toward management of various newly developing and existing salmon fisheries. As a result, comprehensive salmon research programs, that are essential for managing the fisheries on a more scientific basis, could not be developed with the limited State monies available. In 1961 and 1962 some Federal funds were utilized in a short term program of Yukon River chum salmon investigations for the purpose of acquiring information for the International North Pacific Fisheries Commission Treaty negotiations.

With the enactment of the Anadromous Fish Act (P.L. 89-304) in 1966, the A-Y-K area has received a total of $110,000 in Federal funds (matched by an equal amount of State monies) during the 1966-68 fiscal years to expand existing State research programs and to initiate new projects. The overall objectives of the Arctic-Yukon-Kuskokwim Area Anadromous Fish Investigations are to determine population sizes and escapements, destination, movements and timing of different segments or races and life histories of anadromous fish runs (salmon and sheefish) in the Arctic-Yukon-Kuskokwim management area of the State. In addition, the subsistence utilization of anadromous fish populations are to be determined. This Annual Technical Report documents the various anadromous fish projects conducted during the 1968 field season. A total of $47,300 in federal funds and an equal amount in State matching monies were utilized in fiscal year 1968-69. Each study is listed below with an estimate of the percentage of the total expenditure:

1. Yukon River Tag and Recovery Project (40%)
2. Flat Island Test Fishing Studies (5%)
3. Salmon Subsistence Fishery Surveys (20%)
4. Aerial Survey Estimates of Salmon Escapements (10%)
5. Kwiniuk River Counting Tower Project (10%)
6. Age, Sex and Size Composition of Salmon (5%)
7. Lower Yukon and Kotzebue Sound Sheefish Investigations (10%)


A R C T I C
Northern District
B r o o k s
Kotzebue District 331
Kotzebue Sound
Port Clarence District 332
Norton Sound District 333
Norton Sound
Yukon District 334
Kuskokwim Bay
335 District
Kuskokwim
A l a s k a
333-10
333-20
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-- District Boundary
I Sub-District Boundary
A-Y-K

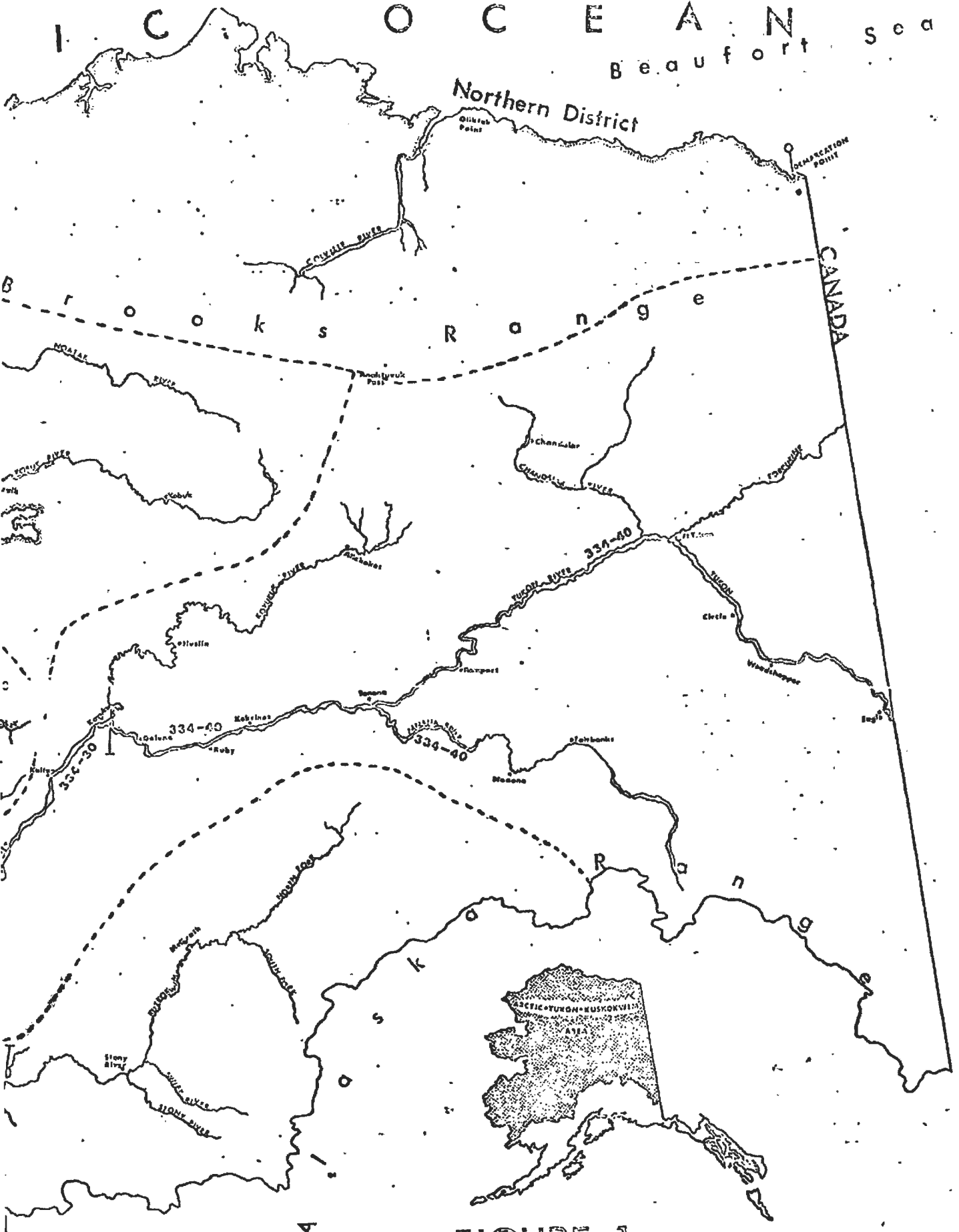


FIGURE 1

A-Y-K AREA MAP

rict Boundary
-District Boundary

YUKON RIVER TAG AND RECOVERY PROJECT, 1968

INTRODUCTION

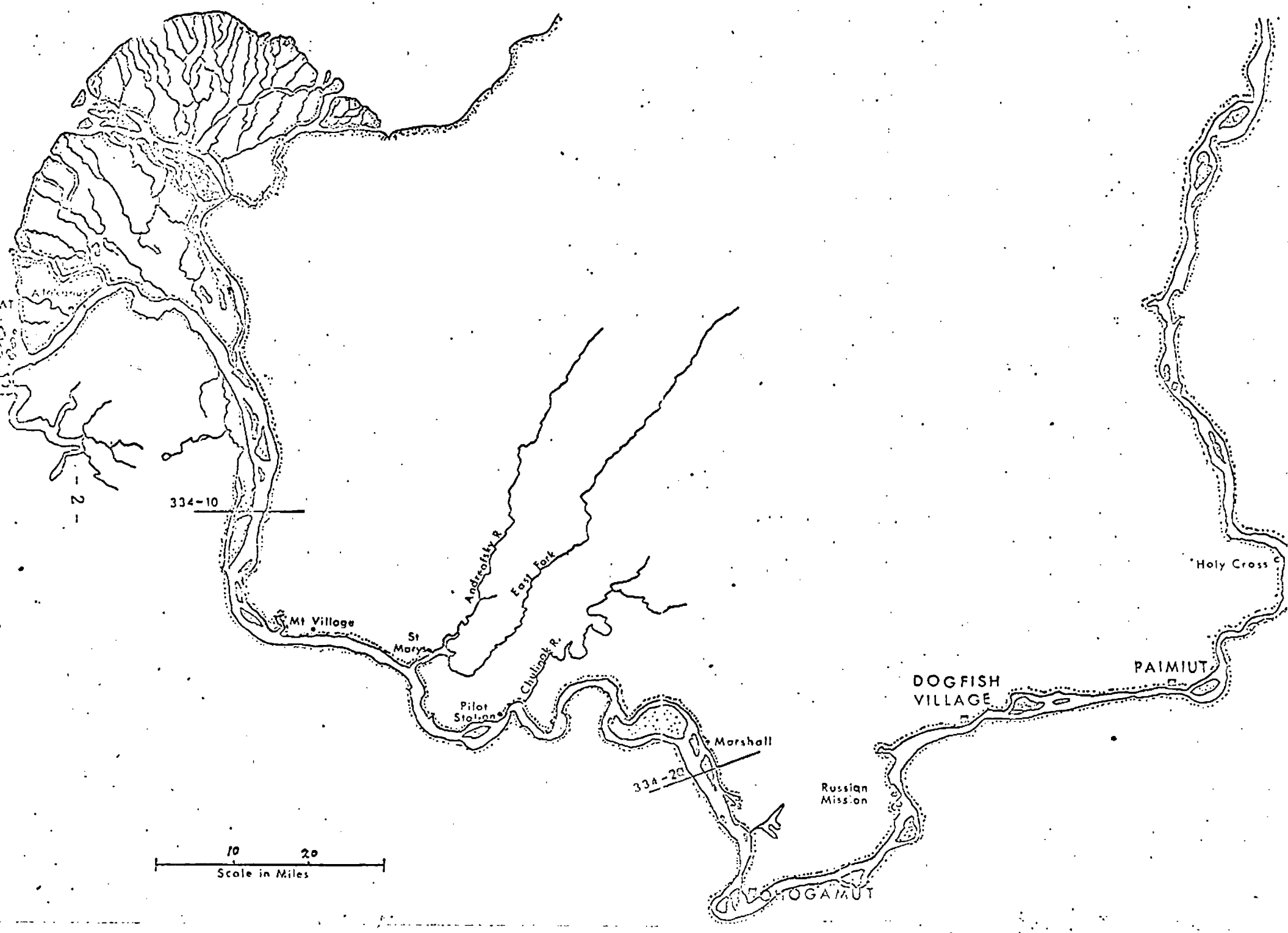
Since 1961 salmon tag and recovery studies have been conducted on the Yukon River in order to obtain estimates of population size, percentage utilization by the commercial fishery, timing and destination of run segments, migration rates and abundance indices. During the years 1961-1967, a total of 2,270 king and 7,600 chum salmon was tagged and released.

In 1961 and 1962 tag and recovery studies utilizing Federal funds were conducted in the vicinity of Mountain Village (Mile 87) to Pilot Station (Mile 122) for the primary purpose of obtaining a population estimate of the chum salmon run. Fishwheels were used to capture chum salmon for tagging in the 1961 and 1962 study. Beginning in 1963, set gill nets were operated annually until 1967 at Flat Island located in the South Mouth for the purpose of capturing king salmon for tagging and for test fishing. In addition to gill nets, a single fishwheel was operated at Flat Island in 1965. In 1966 and 1967, kings were also tagged at the Middle Mouth. Although the tagging projects at the mouths of the Yukon River dealt mainly with king salmon, substantial numbers of chum salmon were captured incidentally and tagged.

In 1968 the Yukon River tag and recovery project was moved upriver, above the main commercial fishery, to Ohogamiut (Mile 185), Dogfish Village (Mile 227) and Paimiut (Mile 251) areas (see Map, Figure 2) because of difficulties encountered with the capture, tagging, and recovery of salmon at the mouth of the river. For example, in 1967, tagging sites were located at only the South and Middle Mouths and king salmon entering the river via the North Mouth and several channels (e.g., Kwiguk, Alakanuk, Bugomowik, etc.) were not available for tagging. Another shortcoming of the downriver tagging sites was the substantially disproportionate number of tag recoveries taken by the commercial fishery nets located at relatively close proximity to the tagging sites. This resulted in failure of the tagged fish to distribute themselves uniformly throughout the untagged population.

Chief advantages of the Ohogamiut tagging site were: (1) the location above the intensive downriver king salmon commercial fishery of sub-districts 334-10 and 334-20 (see Map, Figure 2), (2) tagging would be above confluences of all the mouths and channels of the delta, and (3) fishing effort would not be affected by storms or tidal action.

FIGURE 2. LOWER YUKON RIVER MAP



OBJECTIVES

1. The main objective in 1968 was relocating the tag and recovery projects 185-251 miles upriver, which required transporting a vast amount of supplies and equipment by boat and chartered aircraft. In addition, since the project was located in a new area, considerable time and effort was expended toward locating adequate fishing sites and experimenting with various types of gear to capture salmon for tagging. As a result, the secondary objectives listed below were not completely attained in 1968.

2. Determine population estimate of king salmon passing through the study area (tagging-recovery sites).

3. Distinguish and determine races of king and summer chum salmon and their destinations.

4. Determine general run timing of king and summer chum salmon in study area and effects of the downriver commercial fishery on run timings and escapement into sub-district 334-30.

5. Determine migration rates of king and summer chum salmon passing through the lower Yukon area, specifically between the mouth and the tagging site and various upriver recovery sites.

METHODS AND MATERIALS

Tagging: Various types of nets were employed to capture salmon for tagging. Mainly set gill nets of 5-1/2, 7, 8-1/2 and 9-1/2 inch mesh (stretched measure), usually of 25 fathom lengths, were fished at several different locations on both sides of the river. Some gill nets were hung using crab riser floats, which lowered the corkline of the net below the surface of the water, to test their effectiveness when there is a large amount of driftwood. In addition to set gill nets, some drift gill nets and an experimental beach seine trap were also operated. A beach seine trap is a large seine, a portion of which is anchored offshore and the remaining length trails downstream to form an "inverted L shape trap", that can be hauled to shore with the use of gas powered winches. The successful operation and location of a beach seine trap can be capable of catching large numbers of uninjured salmon for tagging and sampling purposes.

Yellow spaghetti tags, flexible plastic tubing of 1/16 inch diameter, of 13 inch lengths, were used to tag captured salmon. Each tag was inscribed with a number and the legend, "Reward ADF&G Anchorage". The tag was affixed to a stainless steel needle applicator and inserted through the flesh in the vicinity of the dorsal fin. After insertion of the tag, the needle was

removed and the two free ends of the tag were tied tightly into an overhand knot.

For each tagged fish the following information was recorded: species, sex, fork length and condition upon release. The condition of tagged fish was classified into the following general categories: Category 1 consisted of fish considered to be in good condition; Category 2 consisted of fish considered to be in fair condition; and Category 3 consisted of fish considered in questionable or poor condition. Untagged fish, dead fish or fish in very poor condition (e.g., fish bleeding from the gills were not tagged) were sampled for age-sex-size information and then were sold to local processors or given to subsistence fishermen.

Recovery: Set and drift gill nets of 5-1/2, 7 and 8-1/2 inch mesh were operated by the Department recovery crew upriver in attempts to capture tagged salmon. Also, the recovery crew periodically contacted fishermen in the Russian Mission-Holy Cross area for tag recoveries and to monitor their daily catches in order to obtain additional tagged-untagged ratios. Above the Holy Cross area, Department biologists and the subsistence survey crew collected additional tag recoveries. In the Yukon Territory, Canadian Department of Fisheries and Royal Canadian Mounted Police Personnel collected tag recoveries. A reward of $1.00 was offered for each tag returned along with the appropriate recovery information: date and location of tag recovery.

Escapement surveys: Aerial surveys of the Andreafsky River system, located downstream from the tagging sites, were made to determine estimated numbers of salmon spawning below the tagging site.

RESULTS

Several problems, associated with operating the tag-recovery project in the new location, were encountered that resulted in comparatively small numbers of salmon being captured at both the tagging and recovery sites. Prolonged periods of high water, large amounts of driftwood and difficulty in locating suitable fishing sites and developing adequate fishing methods severely hampered operations. The driftwood associated with high water was a particularly difficult problem and severely restricted the effective operation of the gill nets. At times, driftwood was so heavy that nets had to be pulled entirely out of the water. Even gill nets with crab riser floats were not effective in reducing the amount of driftwood in gill nets.

Considerable time and effort was expended in exploring the tagging and recovery sites for suitable set gill net sites where substantial numbers of salmon could be captured. Only a few good sites were located, usually these were commercial fishing sites that were used during closed periods and

after the commercial fishing season closed. Various methods of experimenting with set gill nets, such as modifying the type, length, depth, etc., were attempted in order to increase the catch and reduce the salmon mortality, but without success. Also drifting with gill nets and using an experimental beach seine trap were unsuccessful. The operation of the beach seine trap was hindered by the unavailability of a good site with a gravel bottom. Nearly all potential beach seine trap fishing sites that were found contained a silty bottom which was unsatisfactory for operation of this type of gear (the lead line would become buried in the river bed and, therefore, it would be very difficult to pull to shore).

As a result of the above difficulties, relatively small numbers of salmon in condition suitable for tagging were captured and, consequently, some of the objectives of the tag and recovery program were not completely obtained. It became apparent during the course of the tagging phase of the project that insufficient numbers of king salmon were being tagged to obtain a valid population estimate, the prime objective of the project. The Department recovery crew stationed at Dogfish Village, located 42 miles upstream, did not recapture any salmon tagged at Ohogamiut and, therefore, were unable to obtain a tagged-untagged ratio. The Department crew at the Dogfish Village area were unable to locate suitable fishing sites and develop adequate fishing methods. The Dogfish Village operation was transferred upriver 24 miles to Paimiut on June 30 where better fishing sites were located. Since it soon became apparent that the estimation of the population of king salmon passing through the Ohogamiut area this year was apparently not feasible, the Dogfish Village and the Paimiut projects also began to tag salmon in order to obtain additional information on other objectives of the project: viz., migration rates, timing, and distribution of run segments or races of king and summer chum salmon.

King Salmon

A total of 1,007 king salmon were captured at the tagging sites and 376 (37.3 %) were tagged and released (nearly all kings were captured with set gill nets while a few fish were taken with drift gill nets). In Appendix Table A the daily numbers of king salmon captured, tagged and the number of recoveries by tagging date are shown. Recoveries by tagging site nets made within 24 hours of the date of tagging are not included. Numbers of captured, tagged and recovered king salmon and the percentage tagged and recovered by tagging site is summarized below in Table 1:

Table 1. 1968 Tagging Summary - King Salmon

	Number Captured	Number Tagged	Percent Tagged	Number Recovered	Percent Recovered
Ohogamiut	607	263	43.3	76	28:9
Dogfish Village	104	36	34:6	12	33.3
Paimiut	296	77	26.0	10	13.0
TOTAL	1,007	376	37.3	98	26.1

For all sites combined, the overall recovery rate was 26.1 percent. Nearly all recoveries were taken with set gill nets, usually of 8-1/2 inch mesh, while a few recoveries were taken in fishwheels by upriver fishermen.

Distribution of Recoveries by Area of Recovery

In Table 2 the number and percentage distribution of king salmon tag recoveries by tagging site and recovery area is shown. For all tagging sites the greatest proportion of recoveries were made in the Alaskan portion of the main Yukon River, particularly in the Russian Mission-Holy Cross area where a large amount of fishing effort is located in relatively close proximity to the tagging sites. Of particular interest was the relatively large number of recoveries (10), compared to previous years, made in the Yukon Territory. This was the result of tagging above the downriver intensive commercial fishery which previously had taken a large proportion of tagged fish. The furthest upstream recovery was made at Lake Lebarge near Whitehorse, a distance of 1,715 miles upstream from the mouth.

Distribution of Upriver Recoveries by Tagging Date

Major Yukon River king salmon stocks are found in the Andreafsky River, which drains into the Yukon River at Mile 104, to the headwaters in the Yukon Territory, over 2,000 miles upstream. It would be expected throughout the extensive Yukon River drainage that different major spawning stocks or races would exhibit different migration times. If sufficiently large numbers of kings could be tagged in the lower portion of the Yukon River throughout the duration of the run, and if adequate recoveries were made, it seems likely that it would be possible to demonstrate whether or not differences in migration times exist for each major stock or race. If these differences in migration times could be determined, then the commercial fishery in the lower section of the Yukon River could be selectively regulated in order to insure against overharvesting of any particular stock.

TABLE 2

NUMBER AND PERCENTAGE DISTRIBUTION OF YUKON RIVER KING SALMON TAG RECOVERIES BY AREA, 1968

General Recovery Area1/ (Mileages from mouth)	Tagging Area			
	Ohogamiut	Dogfish Village	Paimiut	Total
Ohogamiut(185)	1(1.4)2/			1(1.1)
Russian Mission(213)	12(16.9)			12(13.2)
Paimiut-Holy Cross(251-279)	22(31.0)	7(63.6)	3(33.3)	32(35.2)
Grayling(336)	1(1.4)			1(1.1)
Nulato(484)	2(2.8)	1(10.0)	1(11.1)	4(4.4)
Bishops Mt.(512)	1(1.4)			1(1.1)
Ruby(581)	4(5.6)		2(22.2)	6(6.6)
Kokrines(608)	1(1.4)		1(11.1)	2(2.2)
Tanana(695)	5(7.0)		2(22.2)	7(7.7)
Rampart(763)	3(4.2)	3(27.3)		6(6.6)
Stevens Village(847)	2(2.8)			2(2.2)
Beaver(932)	1(1.4)			1(1.1)
Fort Yukon(1,002)	1(1.4)			1(1.1)
Eagle(1,213)	2(2.8)			2(2.2)
Subtotal	58(81.5)	11(100.0)	9(100.0)	78(85.8)
Hughes(881) (yukuk River)	2(2.8)			2(2.2)
Subtotal	2(2.8)			2(2.2)
Mouth Goodpaster R.(1,015) (Tanana River)	1(1.4)			1(1.1)
Subtotal	1(1.4)			1(1.1)
Old Crow(1,259)	1(1.4)			1(1.1)
Dawson(1,319)	1(1.4)			1(1.1)
Mayo(1,495)	1(1.4)			1(1.1)
Carmacks(1,550)	5(7.0)			5(5.5)
Pelly Crossing(1,580)	1(1.4)			1(1.1)
Lake Lebarge(1,715)	1(1.4)			1(1.1)
Subtotal (Yukon Territory)	10(14.0)			10(11.0)
Total	71(100.0%)	11(100.0%)	9(100.0%)	91(100.0%)

1/ Recoveries below tagging sites not listed.

2/ Percentage recovery in parenthesis.

In Table 3 the tagging dates for king salmon recoveries made above Mile 484 are shown in relation to the number of tags. King salmon migrating past Mile 484 (Nulato) are mainly destined for the following major spawning areas: Koyukuk River, Tanana River and the upper Yukon drainage in Canada. The data indicated that the percentage of these upriver recoveries was related to the number tagged and not necessarily to the date of tagging. Previous similar analysis yielded the same conclusions (see 1967 Annual Technical Report). It is essential that comparatively large numbers of tags be applied throughout the duration of the run. If this could be accomplished, it could be possible to demonstrate conclusively whether differences in migration times occur for major spawning stocks.

General Run Timing

The daily catches of king salmon for the Ohogamiut, Dogfish Village and Paimiut tagging sites are shown in Appendix Table A. The first king salmon was captured on June 5 at the Ohogamiut site. The Ohogamiut and Dogfish Village tagging sites and the Paimiut subsistence daily catches are graphed in Figure 3 for comparison to the daily catches made at the Flat Island test fishing site. In general, the main peak of the king salmon run in the upriver area (Ohogamiut-Paimiut) occurred during the period June 24-26 and is probably traceable to a peak of the Flat Island daily catch occurring during June 19-22. The migration rate of these untagged fish through the Flat Island-Paimiut area, based on peak catches at various areas, was approximately 42 miles per day. Other peaks in the daily run timing upriver cannot be determined due to limitations of the Ohogamiut and Dogfish Village catch data which probably does not realistically reflect minor fluctuations in the magnitude of the run. The daily catches at these locations were influenced by driftwood and high water which resulted in a decrease in gear efficiency. In addition, fishing sites at both locations were continually changed in an attempt to increase catches.

Migration Rates

In Table 4 the migration rates (rate of travel or speed of migration) of tagged king salmon recovered at various points upstream are presented. The migration rate, in terms of miles per day traveled, was obtained by dividing the days out into the distance traveled. The migration rates presented in Table 4 should not be considered as the actual rate of travel due to limitations inherent in the tag and recovery data: (1) tagged fish are usually in an initially weakened or disoriented condition due to handling and tagging operation, (2) comparatively few numbers of fish were tagged and recovered, and (3) some probable inaccuracies in the reporting of the recovery date by fishermen. Migration rates of tagged fish are usually considered as the minimum rate of travel. In general, the tagging and recovery data shows that the migration rate increased as the distance traveled upstream increased. For example, the migration rates of tagged fish recovered downstream from Holy Cross were less than 20 miles per

TABLE 3

TAGGING DATES OF YUKON RIVER KING SALMON RECOVERIES MADE ABOVE MILE 484 DURING 1968

Tagging Dates	Total No. of Tags	No. of[1] Recoveries	Percentage of Total[1] Recoveries	Percentage of Total[2] Tags
June 4-10	2	0	0.0	0.6
June 11-15	3	1	2.4	0.8
June 16-20	24	3	7.3	6.4
June 21-25	160	21	51.2	42.5
June 26-30	87	9	22.0	23.1
July 1-5	65	5	12.2	17.3
July 6-10	26	2	4.9	6.9
July 11-16	9	0	0.0	2.4
Totals	376	41(41.8%)[3]	100.0%	100.0%

1/ Recoveries above Mile 484.

2/ Total tags applied at all tagging sites.

3/ Percent of total recoveries.

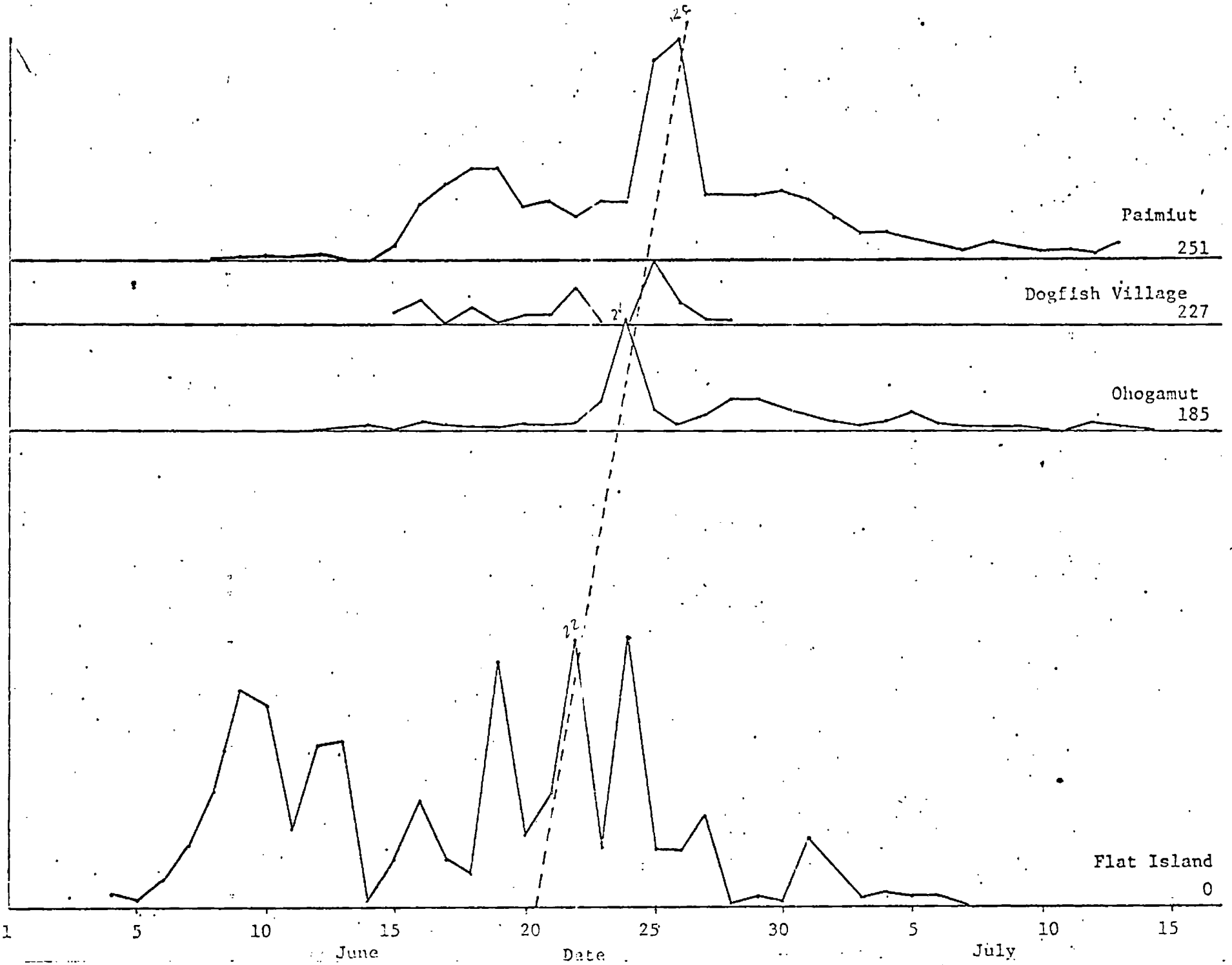

Daily Catches
Paimiut
251
Dogfish Village
227
Ohogamut
185
Flat Island
0
1
5
10
15
20
25
30
5
10
15
June
Date
July

TABLE 4

MIGRATION RATES OF YUKON RIVER TAGGED KING SALMON BY AREA DURING 1968

Area of Recovery	Mileages from Tagging Site	No. of Recoveries	Tagging Dates (Range)	Recovery Dates (Range)	Mean Days Out	Mean Mi Per Da
OHOGAMIUT TAGGING SITE (Mile 185)						
Below Ohogamiut	-	5	6/17-30	6/25-7/10	5.8	-
Ohogamiut	0	1	6/24	6/27	3.0	-
Russian Mission	25-29	12	6/7-7/1	6/10-7/10	4.8	5.8
Paimiut	66	9	6/16-7/7	6/19-7/12	4.9	13.5
Above Paimiut	74-84	11	6/13-6/28	6/14-7/2	4.8	16.2
Holy Cross	97	2	6/16-26	6/23-7/9	10.0	9.7
Grayling	151	1	6/24	6/28	4.0	37.8
Nulato	299	2	6/16-20	6/24-7/?	8.0	37.4
Bishops Mountain	327	1	6/24	7/20	26.0	12.6
Ruby	396	4	6/23-25	7/7-13	17.3	22.8
Kokrines	419	1	7/5	7/18	15.0	36.4
Tanana	510	1	6/20	7/9	19.0	26.8
Above Tanana	540	4	6/22-28	7/8-12	16.7	32.3
Rampart	578	3	6/24-26	7/14-16	20.0	28.9
Stevens Village	662	2	6/24-26	7/5-15	15.0	44.1
Below Hughes	675-784	2	6/28-30	7/14	16.0	42.5
Beaver	747	1	6/24	7/15	21.0	35.6
Fort Yukon	817	1	6/14	7/18	34.0	24.1
Mouth Goodpaster River (Tanana River)	830	1	6/24	8/?	?	?
Above Eagle	1,070	2	6/22-28	8/9	45.0	23.8
Old Crow (Porcupine R.)	1,808	1	6/23	late July	?	?
Dawson	1,130	1	6/27	7/29	32.0	35.3
Mayo	1,310	1	6/19	8/1	43.0	30.5
Carmacks	1,366	5	6/23-7/4	7/18-8/20	40.3	33.9
Pelly Crossing (Pelly R.)	1,395	1	6/30	8/7	38.0	36.7
Lake Lebarge	1,530	1	7/1	8/21	51.0	30.0

TABLE 4 (con't)

MIGRATION RATES OF YUKON RIVER TAGGED KING SALMON BY AREA DURING 1968

Area of Recovery	Mileages Tagging Site	No. of Recoveries	Tagging Dates (Range)	Recovery Dates (Range)	Mean Days Out	Mean Mi Per Da
DOGFISH VILLAGE TAGGING SITE (Mile 227)						
Paimiut	24	1	6/16	6/20	4.0	6.0
Above Paimiut	33	5	6/16-22	6/19-26	2.6	12.5
Above Holy Cross	56	1	6/18	6/29	11.0	5.1
Below Nulato	248	1	6/25	7/3	8.0	31.0
Rampart	536	3	6/17-25	7/5-15	19.7	27.2
PAIMIUT TAGGING SITE (Mile 251)						
Below Paimiut	-	1	7/1	7/7	6.0	-
Paimiut	-	1	6/30	7/4	4.0	-
Above Paimiut	10	1	7/8	7/9	1.0	10.0
Holy Cross	32	1	7/1	7/6	5.0	6.4
Nulato	233	1	7/1	7/14	13.0	16.4
Ruby	330	2	7/2-6	7/14-17	11.5	28.6
Kokrines	353	1	6/30	7/19	19.0	18.6
Tanana	444	1	7/8	7/23	15.0	29.6
Above Tanana	474	1	7/1	7/17	16.0	29.6

day while the migration rate of recoveries made in Canada were in excess of 30 miles per day. The maximum migration rate of a tagged king salmon recorded was 44.1 miles per day.

Recovery of King Salmon Classified as to Condition

In Table 5 the percentage of upstream recoveries of tagged kings in relation to condition at the time of release is shown. Unlike previous years, there was no appreciable difference in recovery rates between the three conditions. This was believed due to the probable difficulty in distinguishing the condition of tagged fish in the upriver tagging areas. At the mouth of the river it is relatively easy to determine the condition of king salmon that have immediately entered freshwater. At the tagging sites located 185 to 251 miles upriver, the kings are apparently better adjusted to freshwater and, consequently, it is difficult to observe differences in condition upon release.

Population Estimate Considerations

As discussed previously, the tag and recovery program experienced several difficulties that resulted in relatively few numbers of king salmon being tagged. A population estimate based on upriver subsistence and commercial fishery recoveries of the king salmon passing through the tagging areas is calculated below, utilizing a simple Peterson formula. The number of king salmon estimated to have passed through the tagging areas, 83,600 fish, and the calculated escapement of 62,033 are probably low due to errors resulting from limitations of the data.

TABLE 5

PERCENTAGE UPSTREAM RECOVERY FOR YUKON RIVER TAGGED KING SALMON CLASSIFIED AS TO CONDITION DURING 1968

Condition Classification	Number Tagged				Percentage Recovery			
	Ohogamiut	Dogfish Village	Paimiut	Total	Ohogamiut	Dogfish Village	Paimiut	Total
1	108	32	63	203	29.6	28.1	12.7	24.1
2	132	3	9	144	25.0	66.7	0	24.3
3	19	1	3	23	31.6	0	0	26.1
Unclassified	3	0	0	3	0	0	0	0
Totals	262	36	75	373	27.1	30.6	22.2	24.1

POPULATION ESTIMATION COMPUTATIONS, YUKON RIVER KING SALMON, 1968

	Commercial Catch	Subsistence Catch	Total
Subdistrict 334-10	79,543	2,277	81,820
Subdistrict 334-20	21,319	1,553	22,872
Subdistrict 334-30	4,543	4,086	8,629
Subdistrict 334-40	1,119	6,839	7,958
Yukon Territory	2,152	2,828	4,980
TOTAL	108,676	17,583	126,259

Flat Island Test Fishing Catches = 831

Andreafsky River[1/] Aerial Survey Escapement Estimate (Minimum count) = 769

Estimated Numbers of Kings Passing Tagging Areas:

Number Tagged = 376
Subdistrict 334-30 and 334-40 and Yukon Territory
Subsistence and Commercial Catches = 21,567
Number of Recoveries[2/] = 97 91

$$\hat{P} \text{ (Population estimate)} = \frac{(376)(21,567)}{97} = 83,600 \qquad \frac{}{91} \quad 89,111$$

Estimated Escapement Passed Tagging Areas:

Population estimate	83,600	89,111
Upriver catches	-21,567	-21,567
Estimated Escapement =	62,033	67,544 (5,511)

TOTAL ESTIMATE OF YUKON RIVER KING SALMON RUN:

Subdistrict 334-10 and 334-20 Subsistence & Commercial Catch:	104,692	
Flat Island Test Fish Catch:	831	
Andreafsky River Escapement Estimate:	769	
Population Estimate Passed Tagging Areas:	83,600	
TOTAL ESTIMATE OF RUN:	189,892	Kings
	195,403	
	+6	: 195,409

1/ Chulinak River, which is located downstream from Ohogamiut and receives a king run, was not surveyed.

2/ Includes only tag recoveries made upriver from the tagging sites.

Chum Salmon

A total of 2,495 chum salmon were captured with mainly 8-1/2 inch mesh set gill nets at the tagging sites and 591 (23.7 %) were tagged and released. In Appendix Table B the daily numbers of chum salmon captured, tagged and the number of recoveries by tagging date are shown. The numbers of captured, tagged and recovered chum salmon and the percentage tagged and recovered by tagging sites is summarized below in Table 6.

Table 6. 1968 Tagging Summary, Chum Salmon

	Number Captured	Number Tagged	Percent Tagged	Number Recovered	Percent Recovered
Ohogamiut	1,094	215	19.7	19	8.8
Dogfish Village	78	20	25.6	1	5.0
Paimiut	1,323	356	26.9	25	7.0
TOTAL	2,495	591	23.7	45	7.6

The overall recovery rate was 7.6 percent for all sites combined. Similar low recovery rates of Yukon River chum salmon captured for tagging with gill nets have occurred in other years (see p. 16 of 1967 Technical Report).

As a result of the small numbers of recoveries (45) a detailed analysis of the chum salmon data will not be undertaken except for some brief comments on distribution of recoveries by area, general run timing and migration rates.

Distribution of Recoveries by Area

Similar to the pattern of king salmon returns, most of the chum salmon recoveries were made in areas relatively close to the tagging sites (Table 7). The furthest upstream recovery was made at Tanana, a distance of 695 miles from the mouth.

General Run Timing

The first chum salmon capture occurred on June 14 at Ohogamiut. The peak of the chum run passed Ohogamiut during June 28 to July 2. At Paimiut the peak of the run occurred during July 5 to 11.

Migration Rates

As noted for king salmon, the migration rates for tagged chum salmon increased as the distance traveled upstream increased. The maximum migration

TABLE 7

MIGRATION RATES OF YUKON RIVER TAGGED CHUM SALMON BY AREA DURING 1968

Area of Recovery	Mileages from Tagging Site	No. of Recoveries	Tagging Dates (Range)	Recovery Dates (Range)	Mean Days Out	Mean Mile Per Day
OHOGAMIUT TAGGING SITE (Mile 185)						
Ohogamiut	0	1	7/9	7/12	3.0	-
Russian Mission	28	3	7/1-4	7/5-8	4.3	6.5
Paimiut and vicinity	66-76	8	6/28-7/5	7/1-9	4.6	6.9
Holy Cross and vicinity	90-98	3	6/26-7/7	7/2-12	5.0	9.3
Anvik	132	2	6/29-7/1	7/6	6.0	22.0
Above Grayling	181	1	7/1	7/?	?	?
Nulato and vicinity	301	1	7/8	8/?	?	?
DOGFISH VILLAGE TAGGING SITE (Mile 227)						
Anvik	90	1	6/18	6/27	9.0	10.0
PAIMIUT TAGGING SITE (Mile 251)						
Below Paimiut	-	3	7/1-8	7/8-15	5.0	-
Paimiut and vicinity	0-10	9	7/1-8	7/4-10	1.4	5.2
Holy Cross and vicinity	30-32	5	7/1-8	7/3-31	7.4	4.3
Anvik	66	3	7/5-10	7/9-14	3.7	17.8
Grayling and vicinity	85-115	2	7/6-8	7/15-16	8.5	23.5
Kaltag	201	1	7/2	7/9	7.0	28.7
Below Nulato	221	1	7/3	7/20	17.0	13.0
Tanana	444	1	7/5	7/20	15.0	29.6

rate recorded of a tagged chum was 29.6 miles per day.

DISCUSSION AND FUTURE PLANS

The 1968 tag and recovery project was hampered by several problems, some resulting from unfamiliarity with the Ohogamiut-Paimiut areas, that drastically affected the numbers of salmon captured and, subsequently, tagged. Even if these difficulties were overcome, it is felt that the present method of capturing salmon for tagging, set gill nets, is unsatisfactory. Of primary concern is the high mortality of gill net caught salmon which results in comparatively few being tagged. For example, only 37.3 percent of the kings and 23.7 percent of the chums captured with gill nets were tagged. Still to be evaluated is the extent of mortality of the tagged fish after release due to the capture, handling and tagging operation. It becomes apparent that another method of capturing relatively large numbers of salmon in suitable condition for tagging is needed.

During the 1969 field season the Department plans to investigate the use of large fishwheels that were successful years ago in the Columbia River king salmon commercial fishery. If this type of fishwheel proves feasible and if good fishing sites can be located, then it is believed that large numbers of king salmon in suitable condition for tagging can be obtained.

SUMMARY

King Salmon

1. In 1968 the Yukon River tag and recovery was transferred upriver to the Ohogamiut-Paimiut areas (Mile 185-251). Several problems were encountered that resulted in relatively small numbers of salmon being captured and tagged: e.g., high water, large amounts of driftwood, difficulty in locating suitable tagging sites, and development of adequate fishing methods.

2. A total of 1,007 kings were captured at the tagging sites with set gill nets and 376 (37.3 %) were tagged and released. Most of the king salmon (70 %) were tagged and released at the Ohogamiut site.

3. A total of 98 recoveries (26.1 %) were recovered by commercial and subsistence fishermen.

4. Tag recoveries were distributed along the entire Yukon River drainage. Most of the tag recoveries were made in the Russian Mission-Holy Cross area where a large amount of fishing effort is located relatively close to the tagging sites. A total of ten recoveries were made in the Yukon Territory.

The furthest upstream recovery was made at Lake Lebarge near Whitehorse, a distance of 1,715 miles from the mouth.

5. Similar to previous years, there was no apparent relationship between the distribution of upriver recoveries (above Mile 484) and the date of tagging. The distribution of tag recoveries upriver was dependent on the number of fish tagged.

6. The first king salmon was captured on June 5 at the Ohogamiut site. The main peak of the king run occurred on June 24-26 in the Ohogamiut-Paimiut area and is probably traceable to a peak in timing of the run at Flat Island near the mouth occurring on June 19-22.

7. In general, the migration rate of tagged king salmon increased as the distance traveled upstream increased. The maximum migration rate of a tagged king recorded was 44.1 miles per day.

8. Unlike previous years, there were no appreciable differences in percentage recovery rates of tagged king salmon in relation to condition upon release.

9. Although relatively small numbers of king salmon were tagged, a population estimate was calculated based on a simple Peterson formula. A total of 83,600 kings were estimated to have passed through the tagging areas. The total estimate of the Yukon River king salmon population was 189,892 fish.

Chum Salmon

1. A total of 2,495 chum salmon were captured with mainly 8-1/2 inch mesh set gill nets at the tagging sites. A total of 591 (23.7 %) were tagged and released.

2. Only 45 recoveries (7.6%) were made. Most of the recoveries were taken in areas relatively close to the tagging sites. The furthest upstream recovery was made at Tanana, a distance of 695 miles from the mouth.

3. The first chum salmon was captured on June 14 at Ohogamiut. The peak of the chum run in the Ohogamiut-Paimiut areas occurred during the period June 28 to July 11.

4. In general, the migration rate of tagged chum salmon increased as the distance traveled upstream increased. The maximum rate of travel for a tagged chum recorded was 29.6 miles per day.

FLAT ISLAND TEST FISHING STUDIES

INTRODUCTION

In 1963, a tag and recovery site was established at Flat Island which is located in the south mouth channel of the Yukon River approximately five miles northwest of Sheldons Point. The main objectives of this project were to determine migration rates, racial differences and population sizes of the king salmon runs. Also, standard test fishing techniques were used each year in order to determine run timing and abundance indices for king salmon. The tag and recovery studies were moved to an upriver location in 1968, but the test fishing studies were continued at Flat Island.

METHODS

During the study period (1963-1968) several set gill nets of varying mesh size were operated each year. The majority of these nets, including a fishwheel operated in 1965, were fished near the north shore of the south mouth channel in the vicinity of Flat Island. The fishing gear was operated for 24 hours a day during most seasons, except in 1964 when the nets were fished an average of about six hours a day during incoming and high tides. All of the catch per hour data presented in Tables 9 and 10 are from a single 25 fathom gill net of 8-1/2 inch mesh that was fished each year just below Flat Island.

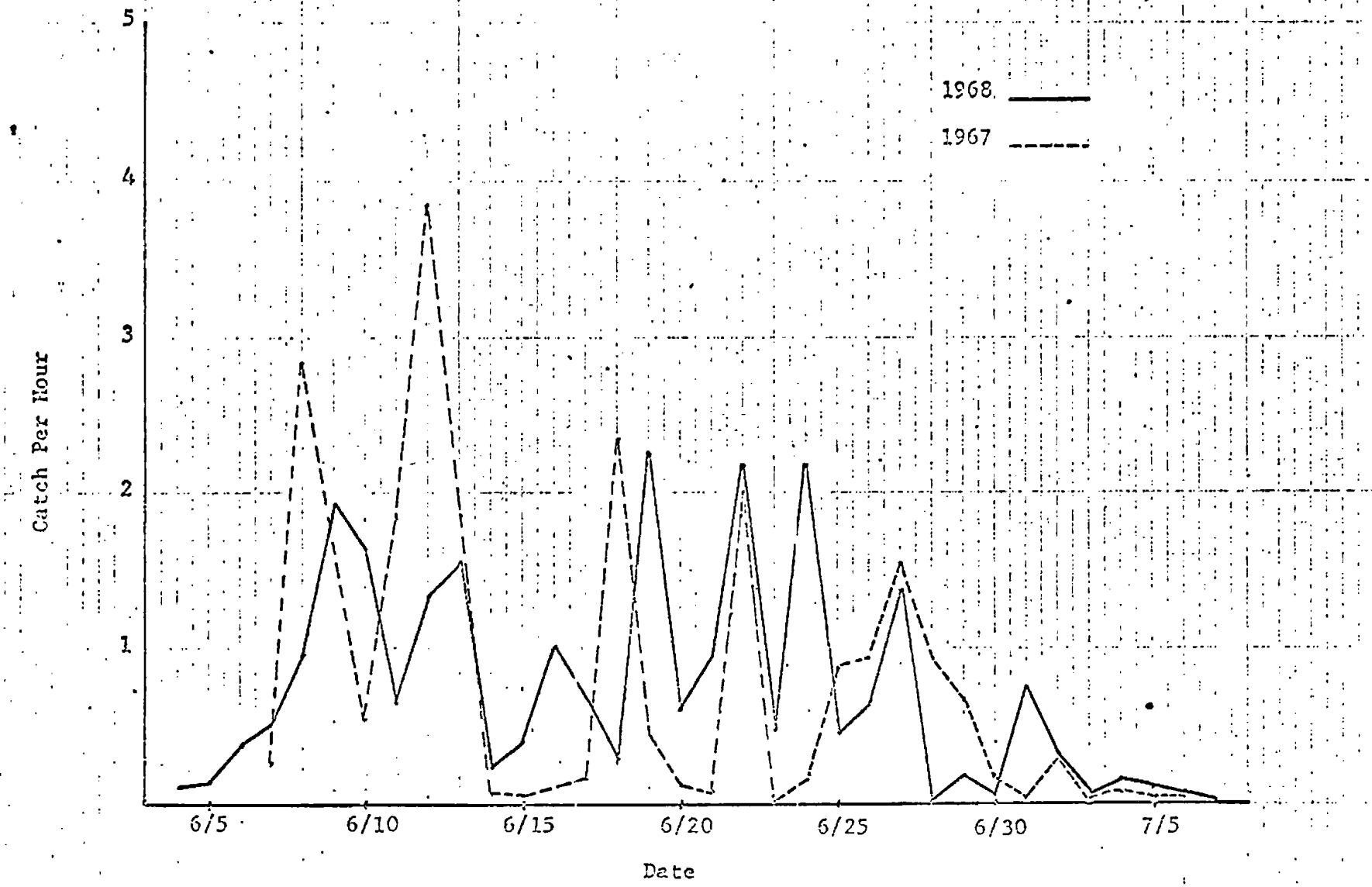
During 1963-1967, all catch data was obtained from gear operated by Department test fishing crews. In 1968, catch data for 8-1/2 inch mesh gill nets was obtained from two commercial fishing sites during the open commercial fishing periods. Department personnel operated similar gear at these two sites during periods closed to commercial fishing. This method of obtaining catch data is considered superior to that of previous years as the commercial fishermen are more skilled in the selection of good fishing sites.

RESULTS

Figure 4 shows the timing of the 1967 and 1968 king salmon runs. These runs were fairly typical of previous runs as a majority of the fish entered the river during June and the abundance of fish varied considerably from day to day. An unusually late winter and cold water temperatures will delay the run for as much as two weeks; e.g., 1964 and 1966 seasons. Even when the runs are unusually late, the majority of the fish will have entered the river by the

Figure 4

King Salmon Catch Per Hour At Flat Island Site, Yukon River, 1967-1968



end of June or the first week of July.

Test fishing catch data obtained since 1963 shows that generally the best catches were made during days completely closed to commercial fishing and the poorest catches were made during days open 24 hours to commercial fishing. This relationship for a 25 fathom gill net (8-1/2 inch mesh) is shown below in Table 8.

Table 8. Test Fishing Catch - Fishing Time Relationship

	Days Open to Commercial Fishing			
	0 hrs.	6 hrs.	18 hrs.	24 hrs.
1963-1966 Daily Catches	57	26	27	10
1967	10	6	10	5
1968	37	43	43	18

Only about 5 percent (estimated 15-20 fishermen) of the commercial fishing gear was located below the test fishing site, yet it is apparent that this small segment of the fishery affected the test fishing catches. This effect may not be entirely the result of the downriver catches but the activities of commercial fishermen may drive the fish into deeper water and out of reach of the test fishing gear.

Table 9 compares the percentages of king salmon captured by date for the commercial fishery (subdistrict 334-12) and the test fishing site during 1967 and 1968. This comparison shows a closer relationship between commercial and test fishing catches for 1968 as compared to 1967. This probably indicates that the 1968 test fishing catches were a better reflection of salmon abundance than in 1967.

Table 10 compares catch per hour data obtained for the last six seasons which are indices of salmon abundance in the south mouth. Fewer days were fished and proportionately more fishing time occurred during the peak of the runs in 1963, 1964 and 1966. Therefore, when comparing catch data for the six year period, these runs were probably not as large as indicated in the table.

Finally, Table 11 indicates the relative catch efficiencies for gill nets of various mesh sizes and a fishwheel operated in 1965. The catch data includes only those days that both types of gear were fished. Gill nets of 8-1/2 inch mesh were the most effective in the capture of king salmon

TA[illegible]

PERCENTAGE CUMULATIVE KING SALMON CATCHES FOR COMMERCIAL FISHERY (SUBDISTRICT 334-12) AND FLAT ISLAND TEST FISHING CATCHES, 1967-1968[1/]

1967			1968		
Date	% Commercial Catch (n=25,826)	% Test Fishing Catch[2/] (n=183)	Date	% Commercial Catch (n=27,898)	% Test Fishing Catch[3/] (n=1,043)
6/3	6	2	6/5	>1	>1
6/6	49	33	6/8	4	9
6/10	54	42	6/12	21	33
6/14	73	66	6/15	48	42
6/17	76	66	6/19	53	58
6/21	85	68	6/22	80	75
6/24	97	81	6/26	95	92
6/27	100	100	6/27	99	96
			7/3	100	100

1/ Test fishing data from a single 25 fathom gill net of 8-1/2 inch mesh.
2/ Does not include 104 kings taken after the close of the commercial fishing season (6/27).
3/ Does not include 16 kings taken after the close of the commercial fishing season (7/3).

TABLE 10

KING SALMON CATCH PER HOUR COMPARISONS,
FLAT ISLAND SITE, YUKON RIVER, 1963-1968[1/]

	FLAT ISLAND (SOUTH MOUTH)			
Year	Fishing Dates[2/]	Total Hours Fished	Total Catch	Catch Per Hour
1963	6/8-6/26	456.0	637	1.40
1964	6/18-7/13	135.9	211	1.55
1965	6/6-7/4	654.9	589	.89
1966	6/13-7/4	446.0	441	.99
1967	6/3-7/7	817.0	282	.35
1968	6/5-7/6	713.0	521	.73

1/ Catch data is from a single 25 fathom gill net of 8-1/2 inch mesh.

2/ Data includes only those dates during when the first and last fish were captured.

TABLE 11

SALMON CATCH PER HOUR FOR VARIOUS TYPES OF FISHING GEAR OPERATED AT THE FLAT ISLAND SITE, YUKON RIVER, 1965-1968[1/]

Year	Inclusive Dates Fished	Type of Gear	Total Hours Fished	Catch Per Hour
		KING SALMON		
1965	6/13-7/2	10" mesh gill net	376	.22
		8-1/2" mesh gill net	456	1.44
1965	6/13-6/27	7" mesh gill net	128	.91
		8-1/2" mesh gill net	216	1.58
1966	6/13-7/8	7" mesh gill net	117	.26
		8-1/2" mesh gill net	198	.76
1967	6/4-6/29	5-1/2" mesh gill net	196	.28
		8-1/2" mesh gill net	431	.41
1968	6/5-7/7	5-1/2" mesh gill net	628	.26
		8-1/2" mesh gill net	616	.72
1965	6/8-7/4	fishwheel	503	.23
		gill nets (all mesh sizes)	2,037	.49
		CHUM SALMON		
1967	6/4-6/29	5-1/2" mesh gill net	196	1.30
		8-1/2" mesh gill net	431	.42
1968	6/5-7/7	5-1/2" mesh gill net	628	.30
		8-1/2" mesh gill net	616	.43

1/ Data includes only those days that both types of gear were operated.

lowed by 7, 5-1/2 and 10 inch mesh gill nets. The fishwheel captured king salmon at about the same rate as did the 5-1/2 inch mesh nets.

DISCUSSION

The catch per unit effort data presented in this report were affected by environmental conditions, varying fishing methods and other factors which are not necessarily related to salmon abundance. Even with these limitations, the test fishing catch data is thought to be the best representation of run timing and magnitude. Commercial catches are not adequate for this analysis because of "gaps" in the data caused by periodic closed fishing periods.

One serious limitation of the study is that the Flat Island catch data cannot be used as an abundance index for the entire Yukon River run. Salmon enter the Yukon River by several mouths, and the proportion of the run entering each mouth varies considerably from year to year. For example, there were 25,826 and 27,202 king salmon taken commercially in the south mouth and middle mouth respectively during 1967. With similar fishing effort, there were only 6,600 kings taken in the middle mouth during 1968 compared to 27,000 kings taken in the south mouth. Another test fishing site should probably be established above the confluences of the major mouths or channels (near Fish Village) in order to establish abundance indices for the entire run.

SUMMARY

1. The timing of the 1967 and 1968 south mouth king salmon runs shows that the majority of the fish entered the river during June and the abundance of fish varied considerably from day to day.

2. Only an estimated 5 percent of the commercial fishing gear was located below the test fishing site, but data is presented indicating that this small segment of the fishery affected the test fishing catches.

3. King salmon catch per hour data is presented for 1963-1968. Because of differences in fishing time, the 1963, 1964 and 1966 runs were probably not as large as indicated by these data.

4. One limitation of the study is that the catch data cannot be used for the entire Yukon River run. Salmon enter the river by several mouths and the proportion of the run entering each mouth varies considerably from year to year.

5. Catch data indicates that 8-1/2 inch mesh gill nets were the most

effective in the capture of king salmon followed by 7, 5-1/2 and 10 inch mesh gill nets. The fishwheel, operated in 1965, captured king salmon at about the same rate as 5-1/2 inch gill nets.

SALMON SUBSISTENCE FISHERY SURVEYS

INTRODUCTION

The subsistence fishery rivals the commercial fishery as the most important utilization of salmon in the Arctic-Yukon-Kuskokwim area. Chum salmon have always been the backbone of the subsistence fishery, with most of the catch being fed to sled dogs. King salmon are reserved almost exclusively for human consumption, although substantial numbers of chum salmon are also eaten. Minor utilization of pink, coho and sockeye salmon is made.

The Alaska Department of Fish and Game has conducted systematic surveys of the Kuskokwim and Yukon River subsistence fisheries since 1960 and 1961 respectively. Beginning in 1967, comprehensive surveys were also conducted in the Norton Sound district and in certain Kotzebue district villages where only limited surveys had been made in the past.

The subsistence fishery surveys are conducted for the following reasons:

1. The documentation of catches and associated fishery data (amount of gear, number of fishermen, etc.) may indicate relative run magnitudes, escapements and trends in the dependence on subsistence fishing which are useful in fishery management.

2. Tag recoveries from both river and high seas projects are collected. The surveys are insurance against a large number of unreported tag recoveries by subsistence fishermen.

3. Documentation of subsistence catches is required in order that these northern salmon stocks continue to qualify under the abstention principle of the I.N.P.F.C. Treaty, i.e., full utilization.

METHODS AND MATERIALS

Most of the subsistence fishery data obtained during 1968 was from personal interviews of fishermen and direct counts of salmon. Some catches were obtained from return of special catch forms or questionnaires that were distributed to fishermen prior to the fishing season.

Two-man crews, traveling by boat, surveyed the majority of the Yukon and Kuskokwim River fisheries, while the other subsistence fisheries were surveyed by biologists traveling in single engine aircraft. Department survey

crews traveled approximately 2,200 river miles and 1,100 air miles to interview fishermen and document catches. The Whitehorse office of the Canadian Department of Fisheries supplied catch information for the Canadian portion of the Yukon drainage.

RESULTS

Table 12 presents the 1968 subsistence catches recorded for each district in the Arctic-Yukon-Kuskokwim area. Also, the total catches for the area are compared for the 1963-1968 period in this table. Table 13 compares catches for the Kuskokwim, Yukon, Norton Sound and Kotzebue districts for those years that Department surveys were made.

In 1968 there was a minimum of 50,490 king salmon and 543,024 salmon of other species taken in the A-Y-K area. Average catches were made by Kuskokwim and Norton Sound district fishermen but catches were below average for the other districts.

DISCUSSION

The recorded subsistence catches represent minimum figures for the following reasons:

1. Catches made late in the season after completion of surveys are not always recorded.

2. Some salmon consumed prior to the time of surveys are not always recorded.

3. Information is incomplete or lacking for some villages: coastal villages between Yukon and Kuskokwim Rivers, St. Lawrence Island villages, Mekoryuk, Nome, St. Michaels, Teller and Goodnews.

Although difficult to document, it is estimated that between 80-90 percent of the actual Arctic-Yukon-Kuskokwim area subsistence salmon harvest has been tabulated by the Department during recent years.

Subsistence catches are influenced by salmon abundance and fishing effort. Several factors affect fishing effort and include the following:

1. Adverse weather and river conditions.

2. Immediate employment situation (short-term construction projects and firefighting).

TABLE 12

ARCTIC-YUKON-KUSKOKWIM AREA
SUBSISTENCE SALMON CATCH, 1968

District	King Salmon	Other Salmon[1/]	Total Salmon
Kuskokwim	35,380	278,008	313,388
Yukon[2/]	14,832	189,607	204,439
Norton Sound	237	50,964	51,201
Port Clarence	40	3,631	3,671
Kotzebue	———	20,814	20,814
Area Total	50,490	543,024	593,514
ea Totals:			
1967	81,832	600,306	682,138
1966	63,576	473,926	537,502
1965	46,571	828,887	875,458
1964	54,235	757,734	811,969
1963	67,271	593,584	660,855
1962	33,506	622,858	656,364
1961	52,617	593,115	645,732

1/ Mainly chum salmon in Yukon and Kuskokwim districts; mainly chums in Port Clarence and Norton Sound districts but substantial number of pinks taken in some years; all chums in Kotzebue district.

2/ Includes Yukon Territory (Canada) catches.

TABLE 13

SUBSISTENCE SALMON CATCHES FOR KUSKOKWIM, YUKON, NORTON SOUND AND KOTZEBUE DISTRICTS, 1960-1968

Year	Kuskokwim District		Yukon District	
	Kings	Other Salmon[1]	Kings	Other Salmon[1]
1960	19,457	337,067		
1961	28,898	185,301	23,719	407,814
1962	13,596	164,417	19,910	358,441
1963	34,615	140,890	32,656	421,625
1964	30,853	214,942	22,817	485,630
1965	26,238	279,303	19,723	458,379
1966	49,280	180,054	14,017	214,236
1967	61,342	221,192	19,661	288,595
1968	32,624	275,799	14,832	189,607

Year	Norton Sound District[2]				Kotzebue District
	Kings	Cohos	Pinks	Chums	Chums
1962					100,000
1963	5	439	16,607	21,806	31,069
1964	565	2,567	9,225	12,486	29,762
1965	574	4,812	19,131	30,772	30,500
1966	269	2,210	14,335	21,873	35,588
1967	817	1,222	17,516	26,807	40,108
1968	237	2,391	36,912	11,661	20,814

1/ Mostly chum salmon.
2/ Incomplete surveys for 1963-1966

3. Decline in dependence on subsistence fishing. Increased welfare payments and more employment opportunities have resulted in a general decline in fishing effort throughout the A-Y-K area. Also snow vehicles are beginning to replace sled dogs and this is expected to speed up the decline of the subsistence fishery in the future.

Subsistence catches of Yukon River chum salmon have declined markedly during the past three seasons. Although adverse fishing conditions and the immediate employment situation have had some effect, the decline is largely the result of a decline in the dependence on subsistence fishing. As shown below in Table 14, there has been a decline in fishermen, sled dogs and the number of fishwheels for the Yukon River:

Table 14. Yukon River Subsistence Fishery Summary

Year	Number of Fishing Familes Surveyed	Number of Dogs Owned	Number of Fishwheels Operated
1961	624	4,806	169
1963	597	4,155	156
1965	541	3,974	127
1967	517	3,135	87
1968	516	2,943	71

Effort and dependence on subsistence fishing has remained relatively stable during recent years for the Kuskokwim River. Large catches of king salmon made during the 1966 and 1967 season are a result of the abundance of this species (see Table 13).

There is some evidence that subsistence fishing effort has declined in the Kotzebue district since 1962. Still, the large chum salmon catch recorded in 1962 was largely the result of run magnitude.

SUMMARY

1. A minimum total subsistence catch of 50,490 kings and 543,024 other species, mostly chums, was recorded in the Arctic-Yukon-Kuskokwim area during 1968.

2. Average catches were made by Kuskokwim and Norton Sound district fishermen, but catches were below average for the other districts.

3. Yukon River chum salmon catches have declined markedly during the past three seasons as a result of a decline in the independence on subsistence

fishing. Subsistence fishing effort and dependence has been relatively stable for the Kuskokwim district.

AERIAL SURVEY ESTIMATES OF SALMON ESCAPEMENTS

The determination of salmon spawning escapements is one of the objectives of the Arctic-Yukon-Kuskokwim Area Anadromous Fish Investigations. Due to the vast size of the A-Y-K area and the numerous salmon spawning streams, the estimates of escapements are determined only for the major or "key" streams annually. Estimates of salmon escapements can be determined by several methods: aerial surveys, counting towers, weirs, foot surveys, etc. The aerial survey method, although probably the least accurate procedure (due to stream, weather and counting conditions), is most commonly used since a relatively large number of streams can be observed in a brief time period. It should be emphasized that aerial survey determination of spawning salmon is considered as estimates or an index of escapement and not the actual or total number of spawners in a stream. If aerial survey procedures are standardized and environmental conditions do not vary much, then estimates (indices) of salmon escapements made at the same stage of the run can be compared from year to year. The "high count" or estimate of escapement, usually made at the peak of spawning, is considered as the best index of the total escapement. Annual escapement indices of major or key streams, plus accurate commercial and subsistence catch data, are of extreme importance to the management biologist for evaluating the run magnitude of various salmon stocks.

In 1968 a total of approximately 175 hours were spent conducting aerial surveys of salmon spawning streams in the A-Y-K area. Both state matching monies and P.L. 89-304 funds were utilized for conducting aerial surveys. The following important salmon spawning streams were surveyed in each district:

KUSKOKWIM DISTRICT

Goodnews River
Kanektok River
Kuskokwim River System
- Kwethluk River
- Kisaralik River
- Tuluksak River
- Aniak River
- Holitna River
- Holukuk River
- George River
- Swift River
- Selatna River
- Tatlawiksuk River

KOTZEBUE DISTRICT

Noatak River System
- Eli River
- Kelly River and Lake

Kobuk River System
- Squirrel River
- Salmon River
- Tututsuk River
- Shungnak River
- Selby River Slough
- Beaver River

YUKON DISTRICT

Yukon River System
- Andreafsky River
- Anvik River
- Salcha River
- Goodpaster River
- Teslin River
- Pelly River
- Big Salmon River
- Little Salmon River
- MacMillan River
- Nisutlin River

NORTON SOUND DISTRICT

Kwiniuk River
Tubutulik River
Unalakleet River
Fish River System
- Niukluk River
- Boston Creek
- Casadepaga River

PORT CLARENCE DISTRICT

Kuzitrin River System
- Salmon Lake
- Grand Central River

KWINIUK RIVER COUNTING TOWER PROJECT, 1968

INTRODUCTION

Since 1965 a counting tower project has been located on the Kwiniuk River, 110 miles east of Nome (see Map - Figure 5). The Kwiniuk River, similar to other major rivers in Norton Sound, receives moderate runs of chum and pink salmon which are harvested by subsistence and commercial fisheries. In order to effectively manage the Norton Sound fisheries, it is important that frequent estimates of escapements during the season be obtained either by aerial survey estimates or tower counts.

Aerial survey methods of estimating salmon escapements generally tend to underestimate the actual numbers of salmon in a stream. During the 1965-1967 seasons, aerial survey estimates were compared to tower counts of the Kwiniuk River salmon escapements. Although aerial survey methods were standardized as much as possible and experienced observers conducted the surveys, it was found that even under ideal observing conditions, the aerial surveys in all cases underestimated the actual numbers of salmon in the river as determined by the tower counts. The best single aerial survey estimate of several surveys made during this three-year period was 74.5 percent of the accumulated tower count at the time of the survey.

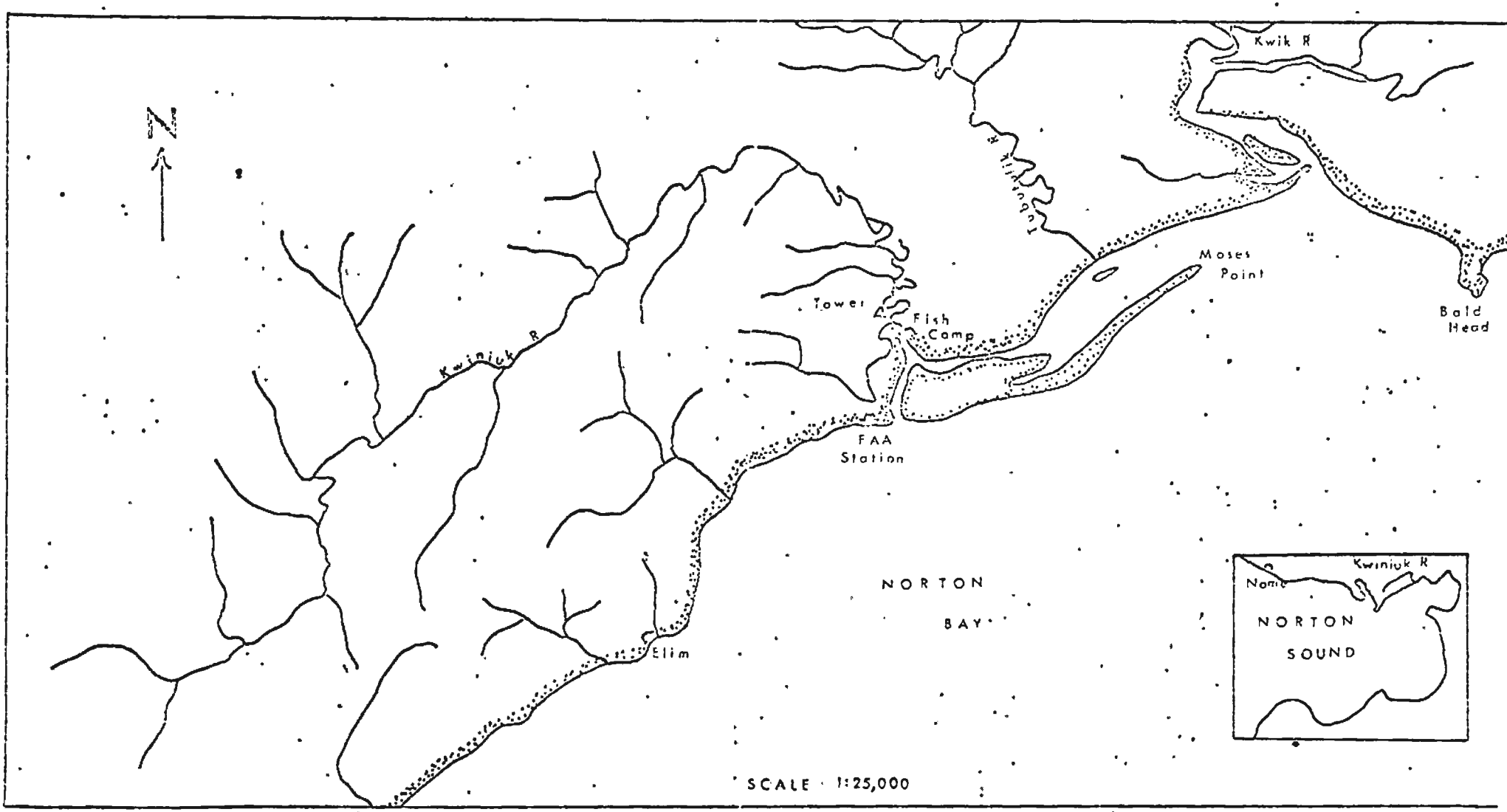
Although aerial survey estimates usually underestimate the escapement, they are of value for obtaining indices of annual levels of escapements of key streams if conducted approximately at the same time period each year. The high count or estimate of salmon escapement, usually made near the peak of spawning, is considered the best index of the total escapement.

In 1968 the priorities of the Kwiniuk River counting tower project were shifted toward obtaining the daily and seasonal timing and magnitude of the salmon runs. Determination of this prime objective is directly applicable toward day-to-day management of other Norton Sound fisheries since the run timing and the escapement trends of the Kwiniuk River are probably similar to the other Norton Sound salmon streams.

METHODS AND MATERIALS

A portable aluminum tower was erected on a high bank above the mouth of the Kwiniuk River. Continuous hourly counts (24 hours per day) were made throughout the salmon runs to obtain the total daily escapement since it has been shown in previous years that only 10- or 20-minute counts per hour would

FIGURE 5 . KWINIUK RIVER SYSTEM MAP



not provide reliable estimates of the daily numbers of chum and pink salmon passing the tower as the result of erratic migration patterns and the relatively small escapements occurring in the Kwiniuk River. It has been demonstrated, however, during the 1966 and 1967 field seasons that 10-minute counts per hour provide reliable estimates of the total seasonal escapement. Ten-minute counts per hour, in addition to the total hourly counts, were continued in 1968.

RESULTS

Estimation of Escapements from Tower Counts

In 1968 a total of 18,976 chum; 129,052 pink; and 27 king salmon were counted past the tower. The daily and total escapements for the years 1965-1968 are presented in Appendix Table C. The total escapement is the total tower count minus the number of salmon taken above the tower by subsistence fishermen. The 1968 salmon runs were distinguished by the largest escapements of pinks and kings and the lowest escapement of chums recorded during the past four years of the counting tower project. Of particular interest, was the phenomenal escapement of pink salmon (126,764), a 12-fold increase over the brood year escapement of only 10,629 pinks in 1966.

The main peak of the chum run occurred during the period July 7-8. The peak of the pink salmon passed the tower during the period July 8-11 when 92,258 pinks were counted. As in past years, nearly all the king salmon had passed the tower by July 15.

Estimate of Total Seasonal Escapements by 10-Minute Counts

The migration pattern of chum and pink salmon past the tower in 1968 appeared to be more variable in respect to hourly timing than in 1966 and 1967. Relative errors (-28.6 % for chums and -17.3 % for pinks) of the total season expanded 10-minute counts compared to the total season actual hour counts were calculated in 1968. In 1966 the relative error was 8.9 percent and 6.2 percent for chums and pinks, respectively. In 1967 the relative errors were -1.6 percent for chums and -12.2 percent for pinks. The 1966 and 1967 experiments demonstrated that 10-minute counts taken each hour resulted in an acceptable estimate of the observed total season escapement. The 1968 10-minute counts, however, did not provide acceptable estimates of the total escapement. It becomes apparent, based on the 1968 data, that continuous hourly counts (24 hours per day) are essential in order to obtain reliable estimates of both the daily and total seasonal escapements of pink and chum salmon.

Observations of Salmon Behavior

In 1968 water levels of the Kwiniuk River were for the most part unusually

low and clear and salmon moving past the tower were easily observed. As in past years, salmon passed the tower primarily during the mid-afternoon to early morning hours. Downstream movements of adult salmon past the tower was negligible compared to previous years.

DISCUSSION AND FUTURE PLANS

During the past four years, 1965-1968, this project has been of immense value in providing day-to-day information on the timing and trends in the size of the pink and chum salmon runs. This data has been especially useful toward management of the Norton Sound fisheries since the Kwiniuk River is considered to be typical of salmon spawning streams that are located in Norton Sound. Since the Kwiniuk River tower project is eventually becoming more and more useful toward management of the salmon fisheries rather than as a strictly research project, it is planned within the near future to utilize only management funds for this project and to channel previously allocated Federal research monies to other programs.

SUMMARY

1. For the fourth consecutive year, a counting tower project on the Kwiniuk River, a typical Norton Sound stream, was operated primarily for the purpose of obtaining the daily and seasonal timing and magnitude of the salmon runs which can be generally applied toward management of the Norton Sound fisheries.

2. Continuous hourly counts (24 hours per day) and 10-minute counts per hour were made throughout the duration of the run.

3. A total of 18,976 chum; 129,052 pink; and 27 king salmon were counted past the tower in 1968. The peak of the chum run occurred on July 7-8 while the pink run peaked during the period July 8-11.

4. Ten-minute tower counts per hour did not provide a reliable estimate of total season escapement of chum and pink salmon in 1968 when compared to the total hourly counts.

5. In 1968 water levels of the Kwiniuk River were generally low and clear allowing for excellent observing conditions; and similar to previous years, salmon passing the tower traveled mainly during the mid-afternoon to early morning hours.

AGE, SEX AND SIZE COMPOSITION OF SALMON

INTRODUCTION

The Arctic-Yukon-Kuskokwim area catch and escapement sampling program, initiated in 1964, was continued and expanded in 1968. A larger number of samples was obtained from most species than in any previous year. However, due to the vast size of the study area and the large number of salmon runs, comprehensive age determinations are either lacking or incomplete for the following species: Kuskokwim River chum and sockeye salmon, Yukon River coho salmon and Norton Sound king and coho salmon.

The objective of this program is to provide such basic management information as age, length, weight and sex composition of the various salmon runs. This information can be used in assessing the effects of a fishery upon run productivity and may be eventually used in making run predictions.

METHODS

Samples were obtained from commercial, subsistence and Department test fishing and tagging site catches. A few samples were also obtained from salmon carcasses found on various spawning grounds. Scale samples were taken from the area of the first or second scale row above the lateral line and located on a diagonal line down from the insertion of the dorsal fin to the origin of the anal fin.

For purposes of this report, a 4_2 salmon returning to spawn in 1968 would be the progeny of the 1964 run that migrated from freshwater to the ocean in the spring of 1966.

It has been impossible to determine whether a few king salmon scale samples (usually less than 10%) have one or two freshwater annuli. This cannot be resolved until adequate samples of smolt are obtained for age and size analysis.

YUKON DISTRICT KING SALMON

Lower Yukon River Commercial Fishery

In 1968 a total of 1,622 Yukon River king salmon was sampled at the Point Adams Packing Company Cannery (Alakanuk) for age, length and sex composition. These fish were taken in the subdistrict 334-10 commercial

fishery from June 3 through July 3 by both set and drift gill nets, the majority of which were 8-1/2 inches stretched mesh. It was not possible to age 287 or 17.7 percent of the sample because of unreadable scales (scales missing, regenerated or inverted on scale cards).

Table 15 shows the age and sex composition of the remaining 1,335 king salmon that were assigned ages. The 6_2 age class represented 64.5 percent of this sample followed by the 7_2 (20.1%), 5_2 (12.8%) and 4_2 (2.6%) age groups.

The sample contained approximately 45 and 55 percent males and females respectively. The sex composition of the 287 fish that were not aged was nearly identical to that of the sample presented in Table 15. Age 4_2 females were not encountered, but females were more abundant than males in the 6_2 and 7_2 age groups. Males were dominant in the 5_2 age class.

As shown in Table 16, males had greater mean lengths than females for all age categories, except the 5_2 age class. This characteristic has been evident in previous Yukon River samples and probably indicates that females experience greater growth initially, but males grow faster after their fourth year. Weights for each age/sex class are not presented in this report but the mean weight of the entire sample was 26.5 pounds (26.1 pounds for males and 26.8 pounds for females).

In Figure 6 the sample is divided into eight periods in order to show changes in age and sex composition during the commercial fishing season. Considering all age classes, males were most abundant during the June 3-8 and June 13-15 periods (53-63%) and females dominated the period samples after June 15 (57-62%).

Age 4_2 fish did not occur until the June 13-15 period and were most abundant during the last two periods. Age 5_2 fish were erratic in abundance, but were generally more abundant late in the season. The percentage composition of age 6_2 males declined steadily during the season, while that of 6_2 females remained relatively constant. Age 7_2 males were most abundant during the June 3-8 period, but remained at a constant low level thereafter. The percentage composition of age 7_2 females remained relatively constant throughout the season.

Table 17 compares age data of the 1968 commercial catch sample to that of samples taken by commercial fishermen and Department test fishing crews (8-1/2 inch mesh gill nets) during 1964-1967. Only moderate changes in age compositions have occurred during the five year period, with the greatest changes occurring in the relative abundance of age 4_2 fish.

Table 15. Age and sex composition of Yukon River king salmon, commercial fishery, 1968.

8-1/2" Mesh Gill Nets

Age Class	MALES No.	MALES Percent	FEMALES No.	FEMALES Percent	COMBINED SEXES No.	COMBINED SEXES Percent
4_2	34	2.6	0		34	2.6
5_2	152	11.4	19	1.4	171	12.8
6_2	315	23.6	546	40.9	861	64.5
7_2	99	7.4	170	12.7	269	20.1
Combined Ages	600	45.0	735	55.0	1,335	100.0

King Salmon, Test Fishing Catches

5-1/2" Mesh Gill Nets

Age Class	MALES No.	MALES Percent	FEMALES No.	FEMALES Percent	COMBINED SEXES No.	COMBINED SEXES Percent
4_2	7	4.8	0		7	4.8
5_2	8	5.5	5	3.5	13	9.0
6_2	50	34.2	52	35.6	102	69.8
7_2	10	6.8	14	9.6	24	16.4
Combined Ages	75	51.3	71	48.7	146	100.0

TABLE 16

LENGTH FREQUENCIES BY AGE AND SEX OF YUKON RIVER KING SALMON COMMERCIAL FISHERY (8-1/2" MESH GILL NETS), 1968

ngth cm.	4_2 Male	5_2 Male	5_2 Female	Length in cm.	6_2 Male	6_2 Female	7_2 Male	7_2 Female
47	1			73		1		
—				74				
53	1	1		75				
54	1			76	2			
55	3			77	3	2		
56	1			78	2	2		
57	3			79	4	3		
58	8			80	4	7		
59	4	1		81	4	14		
60	5			82	10	17		
61	1	1		83	8	26		
62	4	3		84	13	39	1	1
63				85	14	44		2
64				86	18	51		2
65	1	6		87	17	47	1	4
66		2		88	10	47	2	4
67	1	4		89	21	53		9
[illegible]		6		90	20	60	3	6
[illegible]		2		91	17	35		18
70		13		92	25	25		13
71		10		93	20	23	4	18
72		10	1	94	27	17	5	12
73		12		95	18	10	2	13
74		15		96	12	6	5	13
75		17	1	97	9	6	7	12
76		13	2	98	15	2	8	11
77		13	4	99	5	5	7	6
78		4	2	100	10	2	10	9
79		3	1	101	3	2	8	6
80		4	4	102	1		5	4
81		4	1	103	2		5	5
82		2		104			2	
83		2		105	1		6	
84		1	1	106			6	1
85		1	1	107			3	
86			1	108			2	1
87				109			2	
88				110			5	
89		1						
—								
93		1						
[illegible]er	34	152	19		315	546	99	170
[illegible]n	58.4	73.4	78.8		93.6	88.0	100.0	94.5
Length		74.0			90.0		96.0	

FIGURE 6. AGE AND SEX CC SITION OF YUKON RIVER KING SALMON BY FISHING PERIOD, COMMERCIAL CATCH SAMPLE, 1968

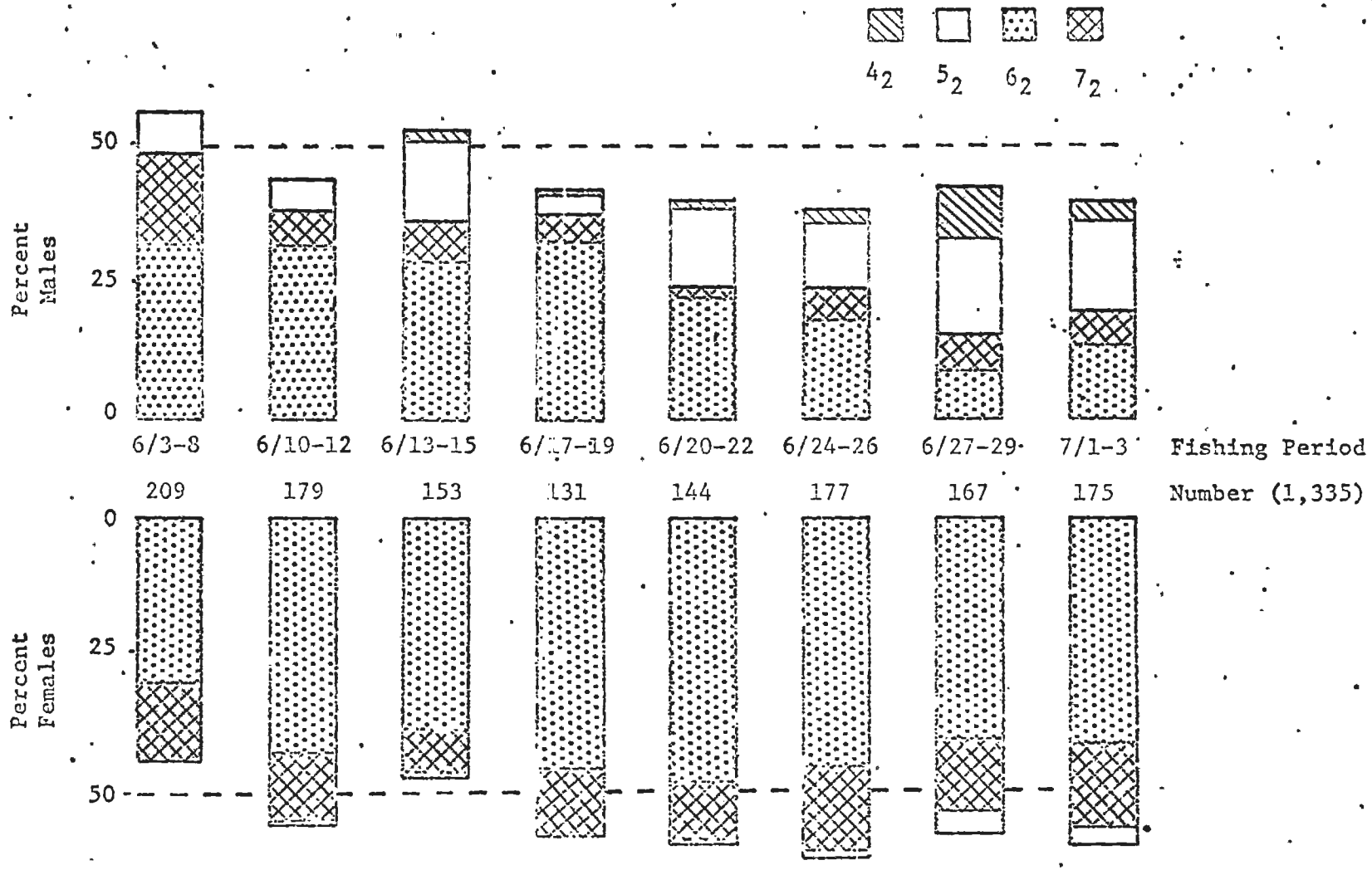


TABLE 17

AGE, SEX AND SIZE COMPOSITION OF YUKON RIVER (SUBDISTRICT 334-10)
KING SALMON SAMPLED DURING 1964-1968

Year	Number	Percent Females	Percent Age Composition (length in centimeters) 4_2	5_2	6_2	7_2	8_2	Combined Age
1964	487	43.3	7.2(54.7)	14.8(74.5)	57.7(84.7)	19.6(91.0)	0.6(89.7)	100.0(82.3)
1965	584	43.8	1.0(51.9)	19.0(72.9)	56.0(84.8)	23.5(89.4)	0.5(89.5)	100.0(83.2)
1966	983	46.5	0.8(55.9)	13.5(72.2)	72.3(85.2)	13.4(90.2)	0.0(-)	100.0(83.9)
1967	991	50.8	0.8(55.3)	10.0(74.1)	73.4(85.7)	15.5(90.7)	0.3(87.5)	100.0(85.0)
1968	1,335	55.0	2.6(58.4)	12.8(74.0)	64.5(90.0)	20.1(96.5)	0.0(-)	100.0(88.5)

Compared to previous samples, the 1968 sample contained the greatest percentage of females and the largest size fish.

Tagging-Recovery Sites

A total of 358 king salmon, captured at upriver tagging and recovery sites, was sampled for age, sex and length composition (Table 18). The majority of these fish were taken with 8-1/2 inch mesh gill nets, but a small undetermined number was also taken with 5-1/2 inch mesh gill nets. Several characteristics of this sample were different from that of the lower Yukon River commercial catch sample:

1. Sex ratio in favor of males (64% versus 45%).

2. Greater percentages of the 4_2 (18% versus 3%) and 5_2 (24% versus 13%) age classes.

3. Lesser percentages of the 6_2 (44% versus 65%) and 7_2 (14% versus 20%) age classes.

4. Smaller mean lengths for all age and sex categories.

Small sample sizes, unequal sampling of run segments and use of different types of gill nets probably biased the above comparisons. However, the distinct differences in age, sex and size compositions between the two samples strongly indicate that the intensive lower Yukon River commercial fishery significantly reduced the abundance of the larger and older fish in the upriver run.

Spawning Ground Samples

Table 19 presents age composition data for carcasses sampled in several tributary streams during 1968. The data for the Andreafsky, Anvik and Salcha Rivers, all Alaskan tributaries, are grouped together because of small sample sizes. The sample from the Teslin River, located in Yukon Territory, Canada, was obtained near Johnson's Crossing.

Alaskan tributary samples differed from the Teslin River sample in having greater percentages of 4_2 and 5_2 fish and smaller percentages of 6_2 and 7_2 fish. Males dominated the Alaskan tributary samples (88.2%) while females dominated the Teslin River sample (76.5%).

Similar characteristics were noted for carcasses sampled from these streams during 1967. The reasons for these differences in age and sex compositions cannot be explained until larger, more representative samples can be obtained.

TABLE 18

AGE, SEX AND SIZE COMPOSITION OF UNTAGGED KING SALMON TAKEN WITH GILL NETS1/ AT OHOGAMIUT, DOGFISH VILLAGE AND PAIMIUT FIELD STATIONS, YUKON RIVER, 1968

MALES					FEMALES					COMBINED SEXES				
Age Class	No.	Percent	Mean Length2/ (cm.)	Mean Weight (lbs.)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs.)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs.)
3_2	1	0.3	38.0	2.5	3_2	0	-	-	-	3_2	1	0.3	38.0	2.5
4_2	60	16.8	57.1	7.2	4_2	5	1.4	57.4	6.6	4_2	65	18.2	57.1	7.1
5_2	69	19.3	70.4	12.4	5_2	15	4.2	72.9	14.1	5_2	84	23.5	70.8	12.7
6_2	63	17.6	90.8	28.2	6_2	93	26.0	87.7	25.4	6_2	156	43.6	88.9	26.5
7_2	37	10.3	98.2	38.5	7_2	15	4.1	94.2	34.4	7_2	52	14.4	97.4	37.2
TOTAL	230	64.3	76.9	19.5	TOTAL	128	35.7	85.5	24.3	TOTAL	358	100.0	80.0	21.2

1/ Mainly 8-12" mesh but includes some 5-1/2" mesh.

2/ Mideye to fork of tail.

TABLE 19

AGE COMPOSITIONS OF YUKON RIVER
KING SALMON CARCASSES, 1968

Age	MALES No.	MALES Percent	FEMALES No.	FEMALES Percent	COMBINED SEXES No.	COMBINED SEXES Percent
Delta, Anvik and Salcha Rivers						
3_2	5	9.8			5	9.8
4_2	7	13.7	1	2.0	8	15.7
5_2	21	41.2	1	2.0	22	43.2
6_2	7	13.7	4	7.8	11	21.5
7_2	5	9.8			5	9.8
Totals	45	88.2	6	11.8	51	100.0
Tanana River						
4_2	1	2.9			1	2.9
5_2	2	5.9	2	5.9	4	11.8
6_2	4	11.8	19	55.9	23	67.7
7_2			5	14.7	5	14.7
Undet. Age	1	2.9			1	2.9
Totals	8	23.5	26	76.5	34	100.0

Test Net (5-1/2 inch mesh) Catch

Table 15 also presents age and sex data for 146 king salmon captured in 1968 with a Department 5-1/2 inch mesh gill net which was operated at Flat Island (South Mouth) from June 6 through July 4. Differences in age and sex compositions between this sample and the commercial catch sample, taken with mainly 8-1/2 inch mesh gill nets, were not as great as anticipated. The 5-1/2 inch sample contained somewhat greater percentages of males (51% versus 45%) and fish of the 4_2 age class (4.8% versus 2.6%). Mean orbit lengths for each age and sex category as shown in Appendix Table D were also very similar to that of the commercial catch sample.

YUKON DISTRICT CHUM SALMON

Summer Chum Salmon

Tables 20 and 21 present age, sex and size composition and length frequencies by age and sex respectively of 413 summer chum salmon taken in test fishing gill nets (5-1/2 and 8-1/2 inch mesh) at Flat Island during June and early July. Age 5_1 fish composed 51.8 percent of the sample followed by the 4_1 (43.1%), 3_1 (4.4%) and 6_1 (0.7%) age classes. Males outnumbered females in all age classes and overall composed 59.5 percent of the sample.

Fish captured with 5-1/2 and 8-1/2 inch mesh gill nets were combined in the sample because of small numbers sampled. Relatively large samples collected during previous years indicated that 8-1/2 inch gill nets "selected out" 5_1 males and 5-1/2 inch gill nets "selected out" 3_1 and 4_1 females.

Table 22 shows the age, sex and size data of 1,071 summer chum salmon taken with 5-1/2 and 8-1/2 inch mesh gill nets at tagging and recovery sites located in the Ohogamiut-Paimiut area. The data is very similar to that of the Flat Island sample.

The percentages of the 5_1 age class in the 1968 summer chum samples were unusually high and surpassed those recorded in all previous samples collected by the Department since 1961. The percentages of 5_1 fish have ranged from 3.7 to 28.8 percent in samples obtained during 1961-1967.

Fall Chum Salmon

Table 23 presents age composition data for 366 fall chum salmon taken during July 27 - August 2 in the lower Yukon River "fall" commercial fishery. Samples were taken during a short period of time as this fishery was conducted from July 22 - August 27. Drift and set gill nets of about 5-1/2 inch mesh were

TABLE 20

AGE AND SEX COMPOSITION OF YUKON RIVER SUMMER
CHUM SALMON, TEST FISHING (5-1/2" AND 8-1/2" MESH GILL NETS), 1968
FORT YUKON

Class	MALES No.	MALES Percent	FEMALES No.	FEMALES Percent	COMBINED SEXES No.	COMBINED SEXES Percent
3_1	12	2.9	6	1.5	18	4.4
4_1	98	23.7	80	19.4	178	43.1
5_1	133	32.2	81	19.6	214	51.8
6_1	3	0.7	0	0.0	3	0.7
Combined Ages	246	59.5	167	40.5	413	100.0

TABLE 21

LENGTH FREQUENCIES BY AGE AND SEX OF YUKON RIVER
SUMMER CHUM SALMON, TEST FISHING (5-1/2" AND 8-1/2" MESH GILL NETS), 1968
FLAT ISLAND

Length in cm.	3_1 Males	3_1 Females	4_1 Males	4_1 Females	5_1 Males	5_1 Females	6_1 Males
48.0	1						
49.0	1						
50.0		1					
51.0	1		1	2			
52.0	3	1					
53.0	1	3	2	4			
54.0		1	6	4		2	
55.0			4	7		3	
56.0	2		10	12	1	3	
0	2		12	13	2	12	
58.0			22	11	1	11	
59.0			18	15	10	15	
60.0			12	7	12	10	
61.0			5	2	20	9	1
62.0	1		1	1	15	10	1
63.0			2		20	4	
64.0			2		21	1	
65.0			1	1	13	1	1
66.0				1	9		
67.0					7		
68.0					2		
Number	12	6	98	80	133	81	3
Mean Length	53.8	53.0	58.1	57.3	62.7	59.2	62.7
	53.3		57.7		61.4		

TABLE 22

AGE, SEX AND SIZE COMPOSITION OF UNTAGGED CHUM SALMON TAKEN WITH GILL NETS1/ AT OHOGAMIUT, DOGFISH VILLAGE AND PAIMIUT FIELD STATIONS, YUKON RIVER, 1968

MALES					FEMALES					COMBINED SEXES				
Age Class	No.	Percent	Mean Length2/ (cm.)	Mean Weight (lbs.)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs.)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs.)
3	22	2.1	55.5	6.0	3	15	1.4	56.3	5.7	3	37	3.5	55.8	5.9
4	291	27.1	60.1	7.6	4	231	21.5	58.2	6.0	4	522	48.6	59.3	6.9
5	321	30.0	62.8	8.9	5	186	17.4	59.2	6.4	5	507	47.4	61.5	8.0
6	4	0.4	65.5	10.0	6	1	0.1	60.0	7.5	6	5	0.5	64.4	9.5
TOTAL	638	59.6	61.4	8.2	TOTAL	433	40.4	58.6	6.2	TOTAL	1,071	100.0	60.4	7.4

1/ Includes both 5-12" and 8-1/2" mesh.

2/ Mideye to fork of tail.

TABLE 23

AGE-SEX-SIZE COMPOSITION OF YUKON RIVER FALL CHUM SALMON, COMMERCIAL FISHERY, JULY 27 - AUGUST 2, 1968

Age	MALES				FEMALES				COMBINED SEXES			
	No.	Percent	Mean Length[1]	Mean Weight[2]	No.	Percent	Mean Length	Mean Weight	No.	Percent	Mean Length	Mean Weight
3_1	6	1.6	55.3	6.7	18	4.9	56.0	6.3	24	6.5	55.8	6.4
4_1	121	33.1	60.8	9.2	208	56.9	59.3	8.0	329	90.0	59.8	8.4
5_1	7	1.9	62.0	10.7	6	1.6	60.5	8.7	13	3.5	61.3	9.8
Totals	134	36.6	60.6	9.2	232	63.4	59.1	7.9	366	100.0	59.6	8.3

1/ Length in centimeters.

2/ In pounds.

operated by commercial fishermen.

Unlike the summer chum salmon samples, the 4_1 age class was most abundant in the fall chum sample (90.0%) followed by the 3_1 (6.5%) and 5_1 (3.5%) age classes. Female fall chums were dominant, composing 63.4 percent of the sample.

Differences in the mesh size of gill nets used to capture the summer and fall chum samples probably influenced the age, sex and size compositions. However, there is good evidence that Yukon River summer and fall chum salmon represents two separate races or stocks differing in the following respects: 1) age, sex and size at maturity, 2) run timing, 3) spawning location and habitat and, 4) early stream life survival.

KUSKOKWIM DISTRICT KING SALMON

Kuskokwim River

Table 24 shows the age, sex and size composition of 560 king salmon taken in the subdistrict 335-10 commercial fishery during 1968 from June 6 - June 25. The majority of these fish were taken with drift gill nets of 8-1/2 inch mesh. The 6_2 age class represented 50.5 percent of the sample followed by the 5_2 (25.2%), 7_2 (18.7%) and 4_2 (3.2%) age groups.

The sex composition of the sample was 56.1 percent for males and 43.9 percent for females. All of the 4_2 and a majority of the 5_2 age fish were males, but females outnumbered males in the six- and seven-year old age groups (222 females:179 males).

Females in the four-, five- and six-year old age classes had greater lengths and weights than males and only seven-year old males were larger than females (Table 24). The mean weight per fish in the sample was 25.0 pounds and the mean length was 85.1 centimeters. In Table 25 length frequencies by age and sex of Kuskokwim River king salmon is presented.

In order to observe changes in age and sex composition during the fishing season, the sample was divided into four periods (Table 26). The sample exhibited similar changes in seasonal age and sex composition when compared to the Yukon River sample (see Figure 6), but the following exceptions were noted:

1. The percentage of males in the Kuskokwim River sample increased steadily during the season from 50.5 percent (June 6-7) to 62.4 percent (June 24-25). This was the result of the abundance of the 4_2 and 5_2 age groups.

TABLE 24

AGE-SEX-SIZE COMPOSITION OF LOWER KUSKOKWIM RIVER
KING SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	MALES Percent	MALES Mean Length[1/]	MALES Mean Weight[2/]	FEMALES No.	FEMALES Percent	FEMALES Mean Length	FEMALES Mean Weight	COMBINED SEXES No.	COMBINED SEXES Percent	COMBINED SEXES Mean Length	COMBINED SEXES Mean Weight
4_2	18	3.2	58.6	8.4	0	0.0	-	-	18	3.2	58.6	8.4
5_2	117	20.9	74.3	16.1	24	4.3	80.5	20.4	141	25.2	75.4	16.9
6_2	126	22.5	86.4	26.0	157	28.0	89.0	27.6	283	50.5	87.9	26.9
6_3	7	1.3	70.4	13.9	2	0.4	85.8	26.3	9	1.7	73.9	16.7
7_2	45	8.0	96.8	35.8	60	10.7	95.2	33.4	105	18.7	95.9	34.4
7_3	1	0.2	99.9	36.4	3	0.5	90.4	29.7	4	0.7	92.8	31.4
										100.0	85.1	25.0
Totals	314	56.1	81.5	22.5	246	43.9	89.7	28.3	560			

TABLE 25

LENGTH FREQUENCIES BY AGE AND SEX OF KUSKOKWIM RIVER KING SALMON, COMMERCIAL FISHERY, 1968[1/]

Length in cm.	42	52		Length in cm.	62		72	
	Males	Males	Females		Males	Females	Males	Females
54	4			63				
55				--				
56		1		68				
57	1			69				
58	5			70	1			
59	2			71	1			
60	2			72	2			
61	1			73	2			
62	2	1		74	2			
63	1	1		75	6			
64		1	1	76	1	2		
65				77	3	3		
66				78	8	2		
67		2		79	3	2		
68		5		80	6	2		
69		8		81	5	4		
70		7	2	82	4	3		1
71		11		83	8	9		
72		14		84	5	8	1	1
73		9		85	13	14		2
74		12		86	3	12		
75		6	1	87	7	12	1	
76		4		88	4	12		
77		9	3	89	3	4	4	2
78		5		90	4	10	3	4
79		3	1	91	2	9	2	5
80		7	4	92	4	2		3
81		4		93	7	10	2	4
82		1	2	94	6	11	2	5
83		1	3	95	1	9	2	6
84		2	2	96	2	2	8	3
85		1	2	97	2	3	4	3
86				98	2	5	2	6
87		1	3	99		3	2	4
88				100	2	1	3	4
89				101	1		1	3
90		1		102	2	3	1	3
				103	2		1	
				104	2		2	
				105			1	
				106			1	1
				107				
				108			2	
Number	18	117	24		126	157	45	60
Mean length	58.6	74.3	80.5		86.4	89.0	96.8	95.2
		75.4			87.9		95.9	

1/ Does not include 9 fish of the 6_3 age class and 4 fish of the 7_3 age class.

TABLE 26

PERCENTAGE AGE AND SEX COMPOSITION OF KUSKOKWIM RIVER KING SALMON BY FISHING PERIOD, COMMERCIAL FISHERY, 1968

Fishing Periods	Sample Size	42	52		62 - 63		72 - 73		All Ages	
		Males	Males	Females	Males	Females	Males	Females	Males	Females
6/6-7	101	1.0	13.8	6.9	30.7	27.7	5.0	14.9	50.5	49.5
6/10-11 6/13-14	182	2.8	16.5	4.9	22.0	26.9	14.3	12.6	55.6	44.4
6/17-18 6/20-21	200	6.4	24.2	3.0	21.8	29.7	5.0	9.9	57.4	42.6
6/24-25	77	0.0	28.6	2.6	27.3	28.5	6.5	6.5	62.4	37.6

2. The percentage of Kuskokwim River age 7_2 females declined steadily during the season.

3. The percentage of Kuskokwim age 6_2 males did not decline sharply towards the end of the season. Unlike the Yukon sample, the Kuskokwim River sample did not include the early and late segments of the run which probably accounts for this difference.

As shown in Table 27, the age and size compositions of commercially caught Kuskokwim River king salmon have been very variable during the past five years. These comparisons indicate good survival and production of 1960 brood year fish during 1965 and 1966. The relatively high percentage of the 5_2 age class in the 1968 sample may indicate similar good survival of 1963 brood year fish which could increase the overall king salmon return during the next year or two. The relative annual abundance of the 4_2 age class in the commercial catches is believed to be affected by buying methods as many of the smaller fish caught were not purchased during some years.

In Appendix Table E fecundities of 23 individual Kuskokwim River king salmon are presented. Fecundity varied from 8,065 to 14,427 eggs and averaged 10,746.

Quinhagak

Table 28 presents age, sex and size data for king salmon taken in the Quinhagak (subdistrict 335-40) commercial fishery. This fishery is located in Kuskokwim Bay adjacent to the village of Quinhagak. A majority of the salmon captured in this area are thought to be of Kanektok River origin, but a few Kuskokwim River salmon are probably intercepted here.

The sample differed from the Kuskokwim River salmon in having greater percentages of age 4_2 and 5_2 fish and lesser percentages of age 6_2 and 7_2 fish (see Table 24). The Quinhagak sample also contained a greater percentage of males and many of the age/sex classes were smaller in size when compared to the Kuskokwim River sample.

The differences between the two samples are believed to be largely the result of different mesh sizes of gill nets operated in the fisheries. Many 5-1/2 inch mesh gill nets are operated in the Quinhagak fishery, but mostly 8-1/2 inch gill nets are used in the Kuskokwim River fishery.

OTHER SPECIES IN KUSKOKWIM DISTRICT

Commercial catches of other species of salmon were sampled as time

TABLE 27

AGE-SEX-SIZE COMPOSITION OF KUSKOKWIM RIVER
KING SALMON, COMMERCIAL FISHERY, 1964-1968

Year	Number	Percent Females	Percent Age Composition (Mean orbit length) 4_2	$5_2 - 5_3$	$6_2 - 6_3$	$7_2 - 7_3$	$8_2 - 8_3$	Combined Ages
1964	681	52.0	1.5(61.6)	20.3(76.6)	64.1(85.9)	13.5(89.6)	0.6(93.3)	100.0(84.2)
1965	370	41.4	0.0(-)	44.9(74.9)	32.4(84.2)	20.8(89.2)	1.9(88.6)	100.0(81.1)
1966	512	49.6	0.4(62.2)	12.1(82.4)	85.2(92.2)	2.3(102.7)	0.0(-)	100.0(91.1)
1967	610	52.6	0.5(66.4)	10.2(75.0)	73.4(89.2)	15.9(93.5)	0.0(-)	100.0(88.4)
1968	560	43.9	3.2(58.6)	25.2(75.4)	52.2(85.2)	19.4(95.8)	0.0(-)	100.0(85.1)

TABLE 28

AGE-SEX-SIZE COMPOSITION OF QUINHAGAK KING SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	MALES Percent	MALES Mean Length 1/	MALES Mean Weight 2/	FEMALES No.	FEMALES Percent	FEMALES Mean Length	FEMALES Mean Weight	COMBINED SEXES No.	COMBINED SEXES Percent	COMBINED SEXES Mean Length	COMBINED SEXES Mean Weight
4_2	31	19.3	55.9	6.9					31	19.3	55.9	6.9
5_2	37	23.0	71.9	14.7	10	6.2	80.9	20.3	47	29.2	73.8	15.9
6_2	28	17.4	87.9	26.8	40	24.8	87.6	24.8	66	42.2	87.7	25.7
6_3	1	0.6	74.9	16.7	1	0.6	79.7	21.6	2	1.2	77.3	19.2
7_2	2	1.2	98.6	34.8	11	6.8	93.3	30.6	13	8.1	94.1	31.2
Totals	99	61.5	71.0	16.1	62	38.5	87.4	25.1	161	100.0	76.9	19.3

1/ In centimeters. 2/ In pounds.

allowed. Appendix Tables F and G show the age, sex and size compositions of Quinhagak chum and pink salmon respectively. Appendix Tables H and I show similar data for Quinhagak sockeye salmon and Kuskokwim River coho salmon.

A total of 14 Qunihagak coho salmon are also sampled and all were classified as age 4_3 fish with mean lengths and weights of 53.2 centimeters and 6.1 pounds respectively.

Appendix Table J presents fecundity data for Kuskokwim River sockeye and chum salmon.

DISCUSSION - YUKON AND KUSKOKWIM DISTRICTS

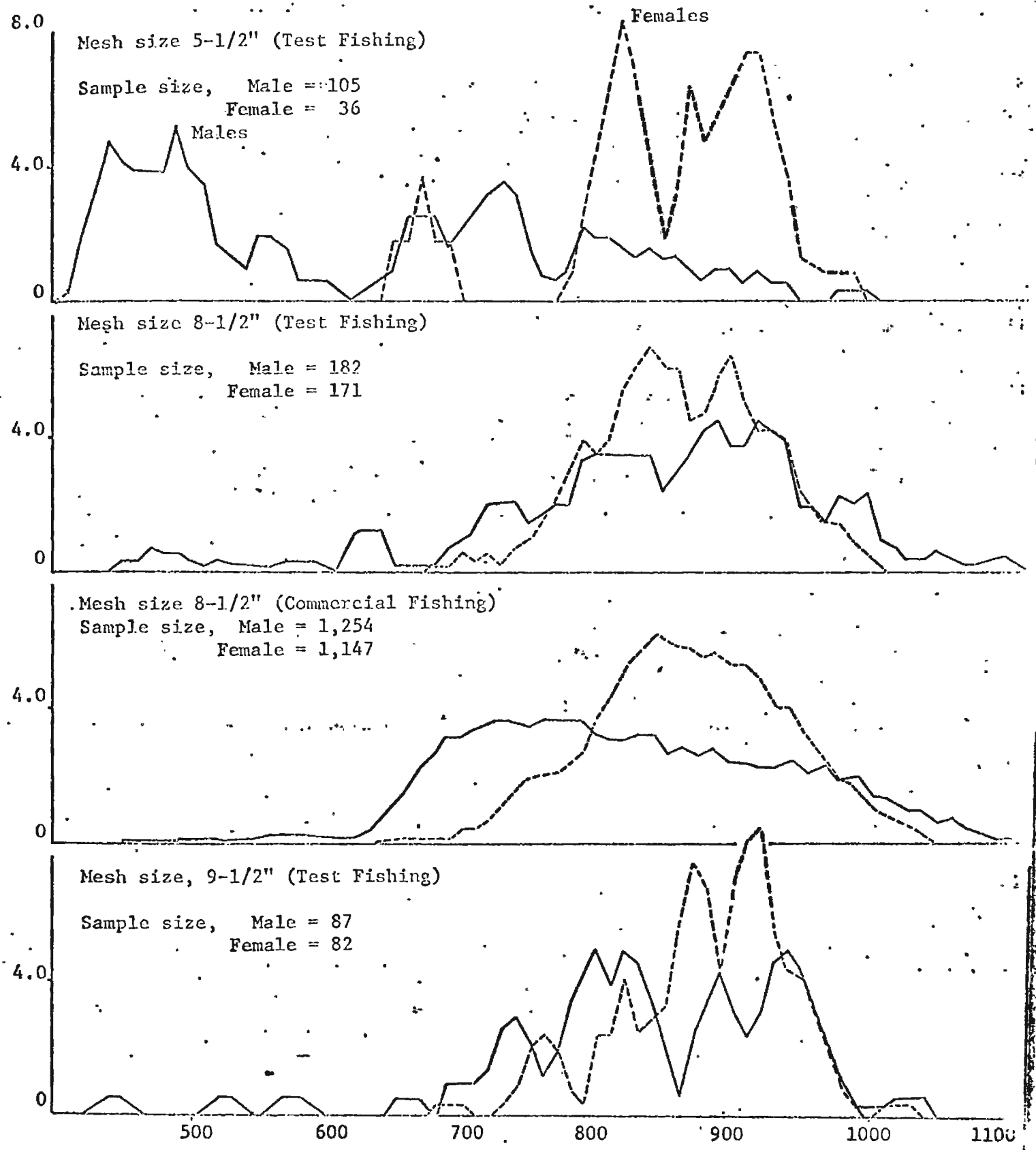
These studies deal with age, sex and size characteristics of commercial catches, but unfortunately little information is known regarding these characteristics for the total run or for the spawning escapement. The effect of an intensive commercial fishery on the quality, as well as the quantity, of the spawning escapement should be of great concern to the fishery management biologist.

Age composition of salmon runs can be expected to vary from year to year because of differences in the survival and return of various brood year stocks. Sex ratios of any particular run, especially for king salmon, also may vary from 1:1 depending on the relative abundance of the various age classes. For example, an unusually large return of age 4_2 and 5_2 king salmon could produce an overall sex ratio in favor of males.

Yukon and Kuskokwim River king salmon runs consist of fish ranging from 3 to 7 (possibly 8) years of age. Because of gill net selectivity for different sized fish, the various age and sex classes are not captured in proportion to their real abundance. It has been shown that 8-1/2 inch mesh (approximate) gill nets, which are operated in the commercial fishery, are selective on age 6_2 and 7_2 females. Figure 7 compares length frequencies of Kuskokwim River king salmon captured with gill nets of varying mesh sizes during the past several years, which illustrates gill net selectivity on sex and size.

Because of the intensive and selective nature of the Yukon and Kuskokwim River fisheries, the resultant king salmon spawning escapements are suspected to be normally composed of a majority of males and relatively high percentages of the 3_2, 4_2 and 5_2 age classes. As previously mentioned, limited sampling of Yukon River spawning escapements have produced contradictory results that were probably influenced by sampling errors. Taku River king salmon, which had passed through an intensive 8-1/2 to 9 inch gill net fishery, had sex ratios as high as seven males: one female.

PERCENT LENGTH FREQUENCIES OF KUSKOKWIM DISTRICT
KING SALMON FOR VARIOUS TYPES OF GILL NET



Snout to Fork Lengths in Millimeters

The optimum sex ratio for spawning king salmon is not known, but a surplus of age 3_2 to 5_2 males in the spawning escapement contributes little to run productivity. A 1:1 sex ratio, or even a majority, of females of the spawning grounds would be best for maximum production. Preliminary data obtained during the past several years indicates that differences of one or two inches in gill net mesh size can considerably alter the age, sex and size composition of the catch. The use of gill nets of a smaller mesh size would reduce the harvest of the more productive females in the older age groups and increase the harvest of the younger age groups which are predominantly males. Thus the catch would be spread out to include some harvest of all of the available age groups.

Other considerations involving the use of smaller mesh gill nets to harvest king salmon would be the effect on the marketability of the catch, increased incidental catch of chum and sockeye salmon and the possible "drop-out" problem associated with the larger sized king salmon.

The 1968 studies also show the occurrence of seasonal changes in age, sex and size compositions of the 1968 king salmon runs. If these changes exhibit similar and distinct patterns from year to year, then it may be possible to alter the characteristics of the catch by altering the fishing season.

It is recommended that age, sex and size studies be continued for all species of salmon with more emphasis placed on assessing age, sex and size characteristics of spawning populations. Future research effort should include a comprehensive gill net selectivity experiment which should be continued for several years to include runs of varying magnitudes and age characteristics.

SUMMARY - YUKON AND KUSKOKWIM DISTRICTS

Yukon King Salmon

1. Age composition of 1,335 Yukon River king salmon sampled from the 1968 commercial catches was 64.5 percent 6_2 fish followed by the 7_2 (20.1 %), 5_2 (12.8%) and 4_2 (2.6%) age groups.

2. Females were dominant in the 6_2 and 7_2 age classes and overall composed about 55 percent of the sample. A majority of the 5_2 and all of the 4_2 age classes were males.

3. The age and sex composition of the sample changed as the season progressed. In general, the percentage compositions of 4_2 and 5_2 fish were greatest late in the season. The relative abundance of 6_2 males steadily declined but that of 6_2 and 7_2 females remained constant during the season.

4. Compared to previous samples, the 1968 sample contained the greatest percentage of females and the largest sized fish (26.5 pounds, both sexes combined).

5. Samples representing upstream catches and carcasses in spawning streams indicate that the intensive commercial fishery of the lower river is selective to the larger size fish, mainly 6_2 and 7_2 females. Age and sex data for Teslin River carcasses (Yukon Territory) is contradictory due to the abundance of 6_2 and 7_2 females.

Yukon Chum Salmon

1. The percentages of the 5_1 age class (about 50%) in the 1968 summer chum salmon samples were the greatest recorded during the 1961-1968 period. The percentage compositions of the other major age classes were about 40 percent for the 4_1 and 4 percent for the 3_1 age classes.

2. Unlike the summer chum salmon samples, the 4_1 age class was most abundant in the fall chum sample (90.0%) followed by the 3_1 (6.5%) and 5_1 (3.5%) age classes.

Kuskokwim King Salmon

1. Age composition of 560 Kuskokwim River king salmon sampled from the 1968 commercial catches was 50.5 percent 6_2 fish followed by the 5_2 (25.2%), 7_2 (18.7%) and 4_2 (3.2%) age groups.

2. The sex composition of the sample was 56.1 percent for males and 43.9 percent for females. All of the 4_2 and a majority of the 5_2 age fish were males, but females outnumbered males in the 6- and 7-year old age groups.

3. The sample exhibited similar changes in seasonal age and sex composition when compared to the Yukon sample, except the percentage of males increased and the percentage of 7_2 females declined steadily during the season.

4. The age and size compositions of Kuskokwim River samples have been very variable during the past 5 years indicating varying survival rates for the various brood years.

Discussion

1. Limited information indicates that the intensive and selective nature of commercial fisheries using 8-1/2 inch mesh gill nets results in

spawning escapements of king salmon having an excess of males and relatively high percentages of 3_2, 4_2 and 5_2 age classes.

2. The use of gill nets of smaller mesh sizes would probably reduce the harvest of the more productive females and increase the harvest of the younger age groups which are predominantly males.

3. It is recommended that studies of the age, sex and size compositions of spawning populations be intensified. Also future research effort should include a comprehensive gill net selectivity experiment.

NORTON SOUND DISTRICT CHUM SALMON

Since 1965 the Department has extensively sampled the commercial and subsistence chum salmon catches in subdistrict 333-30 (Moses Point) for age, sex and size composition data. In 1968 the Norton Sound district age, sex and size composition studies were expanded to include sampling subdistrict 333-60 (Unalakleet) commercial catch as well as the Moses Point area catches.

In the Moses Point area a total of 759 chums were sampled from the commercial catch taken mainly at Moses Point spit and at the mouth of the Kwiniuk River (although a few subsistence catch samples were included) periodically from June 22-July 19, 1968. In Table 29, the age, sex and size composition by sampling period for the Moses Point chum salmon catch sample is presented. In 1968 five-year old chums were the dominant age class (60.6%) followed in order by four-year olds (32.7%), three-year olds (6.1%), and six-year olds (0.6%). In 1968, age classes three and four increased as the season progressed, while five-year olds decreased in abundance. Since only five 6-year old chums were sampled, it was not possible to detect a change in abundance for this age class as the season progressed.

Comparative age and sex composition data of Moses Point chum salmon for the years 1965-1968 is presented in Table 30. During the years 1965-1967, four-year old chum salmon were the dominant age class. In 1968, however, five-year olds were the dominant age class (60.6%). The high percentage of five-year old chums in 1968 probably reflects on the large proportion of four-year olds in 1967 (86.1%). The 1968 chum salmon run in the Moses Point area, in terms of observed escapements into the Kwiniuk and Tubutulik River and the commercial and subsistence catches, was considered to be the lowest of the past four years (1965-1968). The poor Moses Point area chum run in 1968 is probably due to the failure of the dominant age class (four-year olds during most years) to return. Presumably, the offspring of 1964 brood year chum salmon experienced poor survival due to unfavorable environmental conditions.

In the commercial catch sample, females outnumbered males in each

TABLE 29

AGE, SEX AND SIZE COMPOSITION OF SUBDISTRICT 333-30 (MOSES POINT)
CHUM SALMON, COMMERCIAL CATCH SAMPLE, 1968

ate of amples	Combined Age Classes Sex	No.	%	Age 3 No.	%	L.1/	Wt.2/	Age 4 No.	%	L.	Wt.	Age 5 No.	%	L.	Wt.	Age 6 No.	%	L.	Wt.
/22-	Males	79	38.5	0	-	-	-	11	5.3	60.2	8.6	66	32.2	61.7	8.7	2	1.0	63.3	9.8
/26	Females	126	61.5	0	-	-	-	3	1.5	58.0	6.1	122	59.5	59.3	7.2	1	0.5	61.0	8.0
	Sub-total	205	100.0	0				14	6.8			188	91.7			3	1.5		
/2-	Males	110	41.4	5	1.9	55.0	6.5	43	16.2	58.1	7.6	61	22.9	61.5	8.9	1	0.4	65.4	11.8
/6	Females	156	58.6	2	0.8	58.7	7.3	45	16.8	56.4	6.6	109	41.0	57.8	7.1	0	-	-	-
	Sub-total	266	100.0	7	2.7			88	33.0			170	63.9			1	0.4		
/9-	Males	63	48.8	7	5.4	54.2	6.6	34	26.4	57.8	7.9	21	16.3	62.1	9.1	1	0.7	63.7	11.0
/10	Females	66	51.2	4	3.1	53.0	6.3	28	21.7	57.7	6.7	34	26.4	58.6	7.2	0	-	-	-
	Sub-total	129	100.0	11	8.5			62	48.1			55	42.7			1	0.7		
/13-	Males	75	47.2	12	7.5	53.0	6.6	44	27.8	56.4	8.0	19	11.9	60.5	10.7	0	-	-	-
/19	Females	84	52.8	16	10.1	51.9	6.0	40	25.1	54.3	6.7	28	17.6	57.6	7.8	0	-	-	-
	Sub-total	159	100.0	28	17.6			84	52.9			47	29.5			0			
OTAL	Males3/	327	43.1	24	3.2	53.8	6.6	132	17.4	57.6	7.9	167	22.0	61.5	9.1	4	0.5	63.9	10.6
AMPLE	Females4/	432	56.9	22	2.9	52.7	6.2	116	15.3	56.0	6.7	293	38.6	58.5	7.2	1	0.1	61.0	8.0
	Combined Sexes5/	759	100.0	46	6.1	53.3	6.4	248	32.7	56.9	7.3	460	60.6	59.6	7.9	5	0.6	63.3	10.1

1/ Mean length in centimeters.
2/ Mean weight in pounds.
3/ Mean weight (8.4 lbs.); mean length (59.4 cm.).
4/ Mean weight (7.0 lbs.); mean length (57.6 cm.).
5/ Mean weight (7.6 lbs.); mean length (58.4 cm.).

TABLE 30

AGE AND SEX COMPOSITION OF SUBDISTRICT 333-30 (MOSES POINT) CHUM SALMON, 1965-1968[1/]

Year	No. of Samples	Males Percent	Females Percent	Age - Percent 3	4	5	6
1965	568	52.3	47.7	0.8	89.8	9.0	0.4
1966	479	54.9	45.1	7.3	65.1	27.6	-
1967	784	39.3	60.7	1.4	86.1	12.2	0.3
1968	759	43.1	56.9	6.1	32.7	60.6	0.6

1/ Includes both commercial and subsistence catch samples.

sampling period. Unlike previous years, there was no distinct change in sex composition (combined age classes) as the season progressed. In previous years, it has been noted that males tended to decrease while females increased in abundance as the season progressed. Similar to previous years, there was a greater proportion of females (56.9%) than males (43.1%) for the total season sample in 1968.

In 1968 the mean length and weight of Moses Point chum salmon for the combined age and sex classes, was 59.5 cm and 8.4 lbs. respectively. Within all age classes for the total season sample, males were larger than females. It is interesting to note, that due to the large proportion of five-year olds in the catch sample, Moses Point chum salmon were larger (all age and sex classes combined) than previous years. Mean length and weights of Moses Point chums for previous years are as follows: 1965 (59.1 cm and 7.1 lbs.), 1966 (57.3 cm and 7.8 lbs.), and 1967 (58.4 cm and 7.3 lbs.).

A total of 825 chum salmon was sampled in the Unalakleet area during the period July 6-17, 1968 (Table 31). Although the samples were taken slightly after the main peak of the Unalakleet chum salmon run, it is interesting to note that the dominant age class was four-year olds (72.2%) followed by five-year olds (16.7%), three-year olds (10.9%) and six-year olds (0.1%). It has been previously assumed that age composition of chum salmon of the major Norton Sound district streams were similar.

For the total Unalakleet catch sample, females were more abundant (52.7%) than males (47.3%). Within all age classes, males were of larger size than the females. Overall, for the total sample (combined age and sex classes) the mean length was 58.5 cm and the mean weight was 7.4 lbs. Since the Unalakleet chum salmon were predominantly four-year olds, they were smaller than Moses Point chums which were predominantly five-year olds.

SUMMARY

1. In the Norton Sound district a total of 759 and 825 chum salmon was sampled periodically from the commercial catch during 1968 in subdistricts 333-30 (Moses Point) and 333-60 (Unalakleet), respectively.

2. Age composition of the Moses Point catch sample is as follows: five-year olds (60.6%), four-year olds (32.7%), three-year olds (6.1%) and six-year olds (0.6%). As the season progressed, the proportion of three- and four-year olds increased while five-year olds decreased.

3. The Moses Point area chum run in 1968 was considered to be the lowest of the past four years (1965-68) and probably due to the failure of the usual dominant age class (four-year olds) to return.

TABLE 1

AGE, SEX AND SIZE COMPOSITION OF SUBDISTRICT 333-60 (UNALAKLEET)
CHUM SALMON, COMMERCIAL CATCH SAMPLE, 1968 1/

Sex	Combined Age Classes				Age 3				Age 4				Age 5			
	No.	Percent	Length 2/	Weight 3/	No.	Percent	Length	Weight	No.	Percent	Length	Weight	No.	Percent	Length	Weight
Male	390	47.3	59.4	8.0	57	6.9	55.2	6.4	275	33.3	59.6	8.0	57	6.9	62.3	9.2
Female	435	52.7	57.8	6.8	33	4.0	53.6	5.5	321	38.9	57.7	6.8	81	9.8	59.6	7.6
Combined Sexes	825	100.0	58.5	7.4	90	10.9	54.6	6.1	596	72.2	58.6	7.4	138	16.7	60.7	8.2

Age 6			
No.	Percent	Length	Weight
1	0.1	66.7	10.8
0	-	-	-
1	0.1	66.7	10.8

1/ Samples collected July 6 -17, 1968.
2/ Mean length in centimeters.
3/ Mean weight in pounds.

4. As noted in previous years, the proportion of females (56.9%) in the Moses Point commercial catch exceeded the proportion of males (43.1%).

5. Due to greater proportion of five-year olds in the commercial catch sample, the average size of Moses Point chums (59.4 cm and 8.4 lbs.) in length and weight respectively in 1968 was larger than previous years.

6. Age composition of the Unalakleet catch sample is as follows: four-year olds (72.7%), five-year olds (16.7%), three-year olds (10.9%) and six-year olds (0.1%).

7. For the total Unalakleet catch sample, females were more abundant (52.7%) than males (47.3%).

8. Due to the greater proportion of four-year olds in the commercial catch sample, the average size of Unalakleet chums (58.3 cm length and 7.4 lbs. weight) was smaller than the Moses Point chums which contained a greater proportion of the larger five-year old chums.

KOTZEBUE DISTRICT CHUM SALMON

Age, Sex, Size Composition of the Commercial Catch

In 1968 a total of 1,989 chum salmon, representing 6.8 percent of the Kotzebue commercial catch, was sampled periodically during the season from July 14-August 25. Commercial fishing gear consisted of mainly 6.0 inch mesh (stretched measure) set gill nets.

For the combined age and sex classes, four-year olds were predominant (57.3%) followed in order by five-year olds (21.4%), three-year olds (20.3%) and six-year olds (1.0%). Age, sex and size composition data by period is presented in Table 32. As the season progressed, there was a tendency for the proportion of three-year olds to increase while the older age groups decreased in proportion. Comparative age and sex composition data for the Kotzebue commercial catch during the years 1962-1968 is presented in Table 33. The 1968 age composition of the commercial catch was distinguished by a reduced proportion of the usual dominant age class (four-year olds) and nearly equal proportions of three- and five-year olds when compared to past years.

The proportion of females (51.8%) in the commercial catch sample slightly exceeded the proportion of males (48.2%). In past years, the proportions of females sampled from the commercial catch averaged approximately 60 percent. In 1968, as in previous years, there was a tendency for the proportion of males to decrease while females increased as the season progressed.

As documented in the 1967 Technical Report, the size (mean length and weight) of Kotzebue chum salmon sampled from the commercial catch increased as the season progressed. In 1968 during the last two sampling periods (August 8-25) the size of both males and females increased substantially compared to dates of the previous four sampling periods (July 14-August 10). The larger fish sampled during the last two periods can be attributed to the greatest abundance of the larger Noatak River chums at this time.

As noted in previous years, males were larger than females for all age classes. For the combined age and sex classes the chum salmon sampled in the 1968 Kotzebue commercial catch averaged 60.8 cm and weighed 9.7 lbs. In comparison, the average size for Kotzebue chum salmon for the years 1964-1967 were as follows: 1964 (58.6 cm and 8.3 lbs.), 1965 (59.5 cm and 9.0 lbs.), 1966 (61.4 cm and 10.1 lbs.) and 1967 (61.4 cm and 9.3 lbs.).

Noatak and Kobuk River Escapement Sampling

In Table 34 comparative age, sex and size composition data of 126 Noatak River and 90 Kobuk River subsistence caught chum salmon are presented.

TABLE

AGE, SEX AND SIZE COMPOSITION OF KOTZEBUE DISTRICT CHUM SALMON, COMMERCIAL CATCH SAMPLES, 1968

Date of Samples	Combined Age Classes Sex	No.	%	Age 3 No.	Age 3 %	Age 3 L.1/	Age 3 Wt.2/	Age 4 No.	Age 4 %	Age 4 L.	Age 4 Wt.	Age 5 No.	Age 5 %	Age 5 L.	Age 5 Wt.	Age 6 No.	Age 6 %	Age 6 L.	Age 6 Wt.
7/14-7/19	Males	173	65.8	7	2.7	56.5	7.6	83	31.2	61.2	9.6	65	24.7	63.8	10.4	5	1.9	63.6	11.7
	Females	90	34.2	1	0.4	56.5	7.0	46	17.9	59.5	7.9	40	15.2	61.2	8.6	2	0.8	60.8	8.4
	Sub-total	263	100.0	24	9.1			129	49.1			105	39.9			7	2.7		
7/20-7/26	Males	171	46.6	20	5.4	56.3	7.6	119	32.4	61.7	10.1	29	7.9	64.8	11.4	3	0.8	63.4	10.8
	Females	196	53.4	11	3.0	55.9	6.9	143	39.0	60.1	8.3	41	11.2	62.0	9.2	1	0.3	64.1	10.5
	Sub-total	367	100.0	31	8.4			262	71.4			70	19.1			4	1.1		
7/31-8/3	Males	179	44.9	23	5.7	57.9	8.3	119	29.8	61.5	10.1	36	9.0	65.6	12.4	1	0.3	70.8	15.0
	Females	220	55.1	17	4.3	55.6	6.8	158	39.6	60.2	8.5	43	10.8	63.4	10.2	2	0.5	66.0	11.3
	Sub-total	399	100.0	40	10.0			277	69.4			79	19.8			3	0.8		
8/6-8/10	Males	127	43.5	28	9.7	58.3	8.7	69	23.7	61.8	10.9	29	9.9	64.9	12.5	1	0.3	62.8	12.0
	Females	165	56.5	31	10.6	56.9	7.7	107	36.6	59.9	8.8	24	8.2	62.8	10.1	3	1.0	61.2	10.0
	Sub-total	292	100.0	59	20.3			176	60.3			53	18.1			4	1.3		
8/31-8/17	Males	166	43.9	53	14.0	59.5	10.1	77	20.4	62.1	11.5	34	9.0	66.9	14.8	2	0.5	69.9	18.3
	Females	212	56.1	68	18.0	57.2	8.0	99	26.2	60.2	9.4	45	11.9	62.6	10.5	0	-	-	-
	Sub-total	378	100.0	121	32.0			176	46.6			79	20.9			2	0.5		
8/20-8/25	Males	143	49.3	62	21.3	58.7	9.9	56	19.3	60.6	11.2	24	8.3	67.1	15.3	1	0.3	73.5	20.5
	Females	147	50.7	66	22.8	57.2	8.7	66	22.8	60.2	10.2	15	5.2	63.8	10.9	0	-	-	-
	Sub-total	290	100.0	128	44.1			122	42.1			39	13.5			1	0.3		
TOTAL SAMPLE	Males 3/	959	48.2	209	10.5	58.3	9.1	522	26.2	61.5	10.4	217	10.9	65.1	12.4	11	0.6	72.8	13.8
	Females 4/	1,030	51.8	194	9.8	56.9	7.8	620	31.1	60.1	8.8	208	10.5	62.5	9.8	8	0.4	62.7	10.0
	Combined Sexes5/	1,989	100.0	403	20.3	57.6	60.7	1142	57.3	60.7	9.6	425	21.4	63.8	11.1	19	1.0	68.6	12.2

1/ Mean length in centimeters

2/ Mean weight in pounds

3/ Mean weight (10.6 lbs); mean length (61.8 cm.).

4/ Mean weight (8.8 lbs); mean length (60.0 cm.).

5/ Mean weight (9.7 lbs); mean length (60.8 cm.).

TABLE 33

AGE AND SEX COMPOSITION OF KOTZEBUE DISTRICT
CHUM SALMON, COMMERCIAL CATCH SAMPLE, 1962-1968.

Year	No. of Samples	Males Percent	Females Percent	Age - Percent 3	4	5	6
1962	69	26.1	73.9	8.7	62.3	27.5	1.5
1963	255	35.0	65.0	32.6	47.4	18.8	1.2
1964	463	43.6	56.4	55.7	42.5	1.8	-
1965	480	42.1	57.9	2.7	92.3	5.0	-
1966	430	40.2	59.8	8.6	65.8	25.6	-
1967	1,865	37.3	62.7	7.6	70.9	20.7	0.7
1968	1,989	48.2	51.8	20.3	57.3	21.4	1.0

TABLE 34

AGE, SEX AND SIZE COMPOSITION OF NOATAK1/ AND KOBUK2/ RIVER CHUM SALMON, 1968

	MALES					FEMALES					COMBINED SEXES				
	Age Class	No.	Percent	Mean Length3/ (cm.)	Mean Weight (lbs)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs)	Age Class	No.	Percent	Mean Length (cm.)	Mean Weight (lbs)
NOATAK R.	3	10	11.1	58.4	9.8	3	38	42.2	57.6	8.0	3	48	53.3	57.8	8.4
	4	16	17.9	63.0	12.5	4	19	21.2	60.3	9.4	4	35	39.0	61.5	10.8
	5	2	2.2	66.0	13.3	5	3	3.3	66.0	12.2	5	5	5.5	66.0	12.6
	6	1	1.1	77.0	24.4	6	1	1.1	62.0	10.5	6	2	2.2	69.5	17.5
	TOTAL	29	32.2	62.1	12.0	TOTAL	61	67.8	59.0	8.7	TOTAL	90	100.0	60.0	9.8
KOBUK R.	3	28	22.2	57.1	8.3	3	42	33.3	54.8	6.5	3	70	55.5	55.7	7.3
	4	27	21.4	60.7	9.9	4	21	16.7	58.4	7.8	4	48	38.1	58.0	9.0
	5	5	4.0	64.2	11.9	5	1	0.8	58.0	7.5	5	6	4.8	63.2	11.2
	6	2	1.6	67.5	12.0	6	0	-	-	-	6	2	1.6	67.5	12.0
	TOTAL	62	49.2	59.6	9.4	TOTAL	64	50.8	56.0	7.0	TOTAL	126	100.0	57.8	8.2

1/ Noatak River chum salmon taken with beach seine.
2/ Kobuk River chum salmon taken with gill net.
3/ Mideye to fork of tail.

The Noatak River chums were sampled from beach seine catches taken on the spawning grounds near Noatak Village in mid-September. The Kobuk River samples were obtained from set gill net catches of migrating chums taken in the lower main river near the villages of Noorvik and Kiana during early August. Although the sample sizes from both rivers were small and the two different types of gear were used (beach seines and set gill nets), some interesting comparisons may be made regarding the age and size composition of the Noatak and Kobuk River chum salmon samples.

For the combined sex classes of both river systems, the age compositions were nearly identical with three-year olds the most predominant followed in order by four-, five- and six-year olds. The high proportion of three-year olds sampled in the upriver catches may reflect on the selectivity of the commercial set net gear (6.0 inch mesh) in Kotzebue Sound which probably captures mainly the larger sized fish, i.e., mainly the four- and five-year olds. The high proportion of three-year olds sampled from the Kobuk River subsistence catches is probably due in part to the selectivity of the smaller mesh subsistence set gill nets (5-1/2 inch or less). However, the Noatak River subsistence catch samples were probably not biased by gear selectivity, since beach seines are presumed to be non-selective.

As noted in 1967, Noatak River chum salmon in the catch sample, within all age and sex classes, were considerably larger than Kobuk River chums in 1968. For the combined age and sex classes, Noatak River chum salmon averaged 60.0 centimeters in length and 9.8 pounds in weight compared to an average length of 57.8 centimeters and weight of 8.2 pounds for Kobuk River chums. A tag and recovery program, conducted during 1966-1968, has shown that the peak of the Kobuk River chum salmon run passes through Kotzebue Sound earlier in the season compared to the Noatak River run. Differences in the sizes, noted above from commercial and subsistence catch samples, are probably related to differences in the amount of ocean growth made during the current season of these two runs.

SUMMARY

1. A total of 1,989 chum salmon were sampled periodically from the Kotzebue commercial catch in 1968.

2. For the combined age and sex classes, four-year olds were predominant (57.3%) followed in order by five-year olds (21.4%), three-year olds (20.3%) and six-year olds (1.0%). The 1968 age composition of the Kotzebue commercial catch was distinguished by a reduced proportion of the usual dominant age class (four-year olds) and nearly equal proportion of three- and five-year olds when compared to past years.

3. Unlike previous years, when the proportion of females sampled in the Kotzebue commercial catch averaged approximately 60 percent, the 1968 sex ratio slightly favored the females (51.8%) over the males (48.2%).

4. As the season progressed the size of Kotzebue chum sampled from the commercial catch increased, particularly during the last two sampling periods when there was a greater abundance of the larger Noatak River chums.

5. In 1968 the size of chum salmon sampled in the Kotzebue commercial catch averaged 60.8 cm in length and weighed 9.7 lbs.

6. A total of 126 Noatak River chum salmon were sampled from the subsistence beach seine catches and a total of 90 Kobuk River chums were sampled from subsistence set gill nets.

7. For the combined sex classes of both river systems the age compositions were nearly identical, with three-year olds the most predominant followed in order by four-, five- and six-year olds. The high proportion of three-year olds sampled in the upriver catches may reflect on the selectivity of the commercial set net gear in Kotzebue Sound which probably captures mainly the larger, older age groups.

8. As noted in 1967, Noatak River chum salmon in the catch sample, within all age and sex classes, were considerably larger than Kobuk River chums in 1968.

LOWER YUKON SHEEFISH TAGGING STUDIES, 1967-1968

INTRODUCTION

Sheefish or innconu (Stenodus leucichthys) are distributed throughout most of the Yukon River drainage. Both anadromous and resident populations of sheefish occur in the Yukon River system. Resident populations are known to occur in the upper Yukon River drainage. Anadromous populations of sheefish are found in the lower portion of the Yukon. In order to obtain information on the movements and distribution of sheefish, a very limited sheefish tag and recovery program, in conjunction with the Department's king and chum salmon tag and recovery program, was initiated in 1967 near Alakanuk (at Casey Channel) of the South Mouth and expanded considerably in 1968 at the Ohogamiut-Paimiut areas (Mile 185-251) (see Map, Figure 8). All sheefish captured and tagged were caught incidentally to the salmon tagging site catches.

METHODS AND MATERIALS

Sheefish were captured incidentally to the salmon with trammel nets and set gill nets of mainly 8-1/2 inch mesh stretched measure. Scale samples and the fork length of each fish was recorded prior to tagging. Yellow spaghetti tags, identical to the type used for tagging salmon, were applied to each sheefish. Recoveries of tagged sheefish were dependent on the cooperation and assistance of commercial and subsistence fishermen. A reward of $1.00 was offered for each tag returned along with the appropriate recovery information: date and location of the tag recovery.

RESULTS

In 1967 a total of only 13 sheefish were captured at the Casey Channel site in the South Mouth and 10 (76.9%) were tagged and released during June 1-2. One (1) recovery (10.0%) has been made to date (see Table 35). This recovery was made at Pitkas Point, 103 miles upstream, over a year later on July 4, 1968.

In 1968 a total of 345 sheefish were captured and 154 (44.6%) were tagged and released at the Ohogamiut, Dogfish Village and Paimiut tagging sites during the period June 4-July 16 (see Table 36). Approximately 80 percent (124) of the sheefish were tagged at the Dogfish Village site. Overall, for the combined sites, a total of 10 recoveries (6.5%) was made in 1968. A total of 8 recoveries was made upstream from the tagging sites including 2

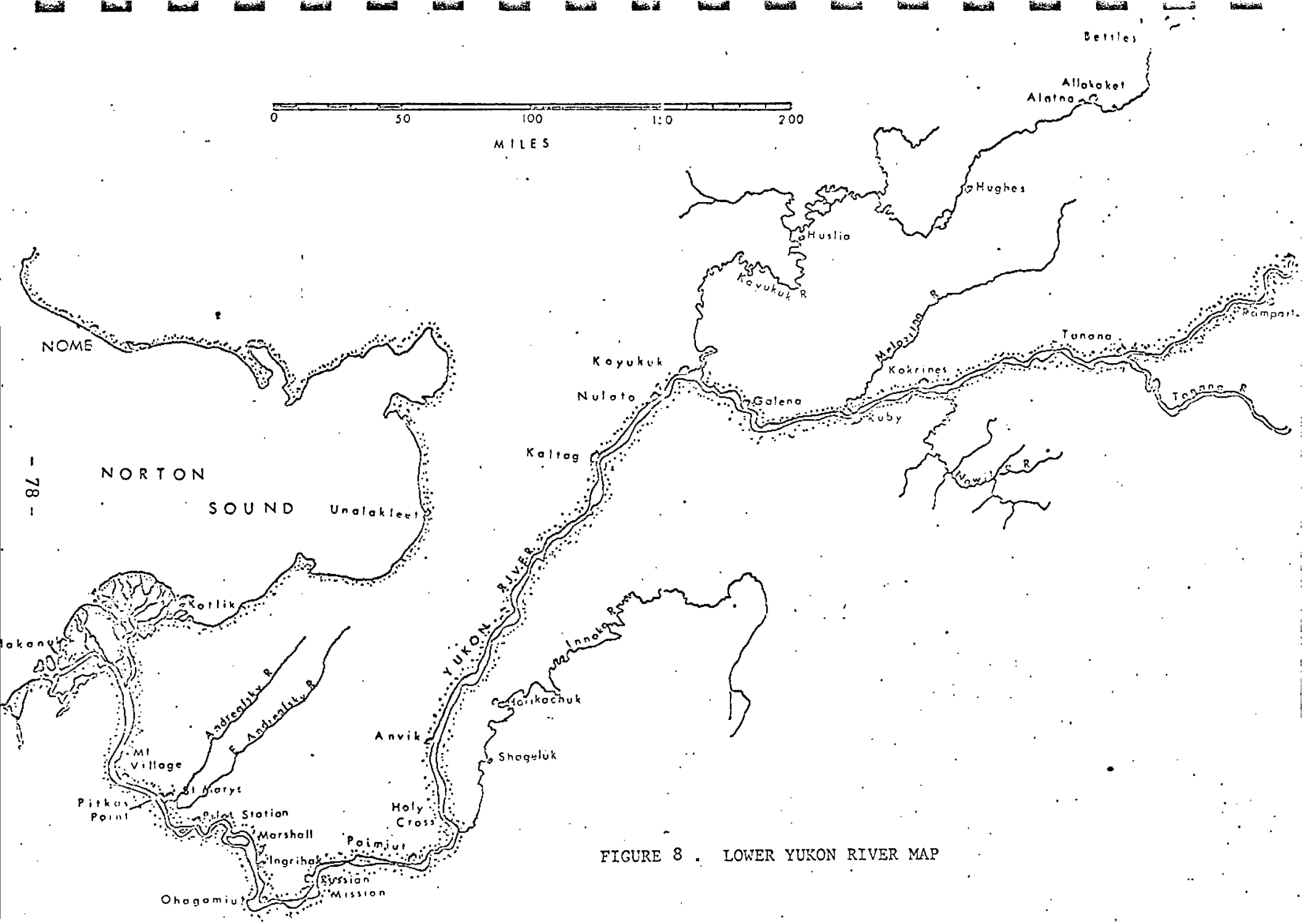


FIGURE 8 . LOWER YUKON RIVER MAP

TABLE 35

NUMBERS OF YUKON RIVER SHEEFISH TAGGED,
CAPTURED AND RECOVERED DURING 1967

CASEY CHANNEL SITE (South Mouth)

Tagging Date	Number Tagged	Number Untagged	Total Catch	Number of Recoveries 1/	Recovery Date	Recovery Location
6/1	8	3	11	0		
6/2	2	0	2	1	7/4/68	Pitkas Point (Mile 103)
Total	10	3	13	1 (10.0)		

1/ Figures in parenthesis represent recovery percentages of tag out.

TABLE 36

NUMBERS OF YUKON RIVER SHEEFISH TAGGED, CAPTURED AND RECOVERED DURING 1968

Tagging Dates	Number Tagged	Number Untagged	Total Catch	No. of Recoveries	Recovery Date	Recovery Location
OHOGAMIUT SITE (Mile 185)						
6/4-7/16	29	35	64	4(13.8)1/	11/22	Kotlik (North Mouth)
					6/27	Paimiut (Mile 251)
					7/9	Ingrihak (Mile 170)
					8/28	Above Nulato (Mile 488)
DOGFISH VILLAGE (Mile 227)						
6/9-7/12	124	156	280	6(4.8)1/	7/8	Above Paimiut (Mile 261)
					9/19	Below Hughes, Koyukuk R. (Mile 869)
					7/30	Above Paimiut (Mile 261)
					9/8	Above Hughes, Koyukuk R. (Mile 883)
					8/8	Above Nulato (Mile 489)
					9/13	Bishops Mountain (Mile 512)
PAIMIUT (Mile 251)						
6/29-7/12	1	0	1	0		
GRAND TOTAL	154	191	345	10(6.5)1/		

1/ Figures in parenthesis represent recovery percentages of tags out.

recoveries taken near the spawning grounds of the Koyukuk River, approximately 650 miles upstream from the release point, during September when sheefish spawn. Koyukuk River sheefish spawn in the vicinity of the village of Hughes. Also sheefish spawn in the Alatna River, a tributary of the Koyukuk River. Two recoveries were made downstream from the tagging sites. Of particular interest was a tagged sheefish recovered at Kotlik, North Mouth, on November 22, 1968. This sheefish may have presumably spawned during late September in one of the tributaries and following spawning, had proceeded downstream to the mouth of the Yukon River.

It is expected that additional recoveries from the 1968 tagging projects will be made in future years. In 1969 larger numbers of sheefish will hopefully be tagged and released. As additional recoveries will be reported in the future, important information on the movements and distribution of sheefish in the Yukon River drainage will be obtained.

SUMMARY

1. In 1967 and 1968 limited numbers of sheefish, captured incidentally to salmon, were tagged and released near Alakanuk (Casey Channel) at the South Mouth and in the Ohogamiut-Paimiut areas of the Yukon River.

2. A total of 10 sheefish were tagged near Alakanuk in 1967 and one (1) recovery was made upstream at Pitkas Point (Mile 103) a year later.

3. In 1968 a total of 154 sheefish was tagged and released at the Ohogamiut-Paimiut areas and 10 recoveries were made in 1968. Of interest were 2 recoveries taken near the spawning grounds on the Koyukuk River in September, 1968. Also one (1) tagged sheefish was recovered at Kotlik, North Mouth, during late November, 1968.

KOTZEBUE SOUND SHEEFISH INVESTIGATIONS, 1968

INTRODUCTION

Sheefish or innconu (Stenodus leucichthys), a member of the whitefish family Coregonidae, are distinguished by a large mouth, extended lower jaw and large scales. Much larger than whitefish, they often weigh as much as 50 to 60 pounds. Sheefish are distributed throughout Arctic North America and Siberia. In Alaska sheefish are found primarily in the Kuskokwim, Yukon, Selawik and Kobuk River drainages. Sheefish are considered anadromous in Alaska waters although resident populations are known to occur in the upper Yukon River system.

In the Kotzebue Sound area, sheefish are found in the Kobuk and Selawik Rivers. After breakup of the river ice in late May or early June, sheefish ascend the Kobuk and Selawik Rivers and during late September spawn in the upper reaches of these main rivers. Following spawning, sheefish move downstream into the brackish-saline waters of Hotham Inlet, Kobuk Lake and Kotzebue Sound and spend 7 to 8 months there.

Residents of the Kotzebue Sound area (see Map, Figure 9) utilize sheefish for subsistence purposes. Subsistence fishermen along the Kobuk River take moderate amounts of sheefish with gill nets as they migrate upstream toward their spawning grounds and also capture sheefish with gill nets during the post-spawning downstream migration period. Also, some residents of the upper Kobuk River harvest sheefish near the spawning grounds with beach seines. In the Selawik area, fishermen take sheefish with gill nets and by jigging with lures under the ice in the Selawik Lake-Inland Lake area. Kotzebue residents take sheefish for subsistence under the ice with gill nets and by jigging with lures.

A limited commercial fishery exists near the village of Kotzebue. About 10 to 20 fishermen using set gill nets and by jigging with lures through the ice take sheefish in small quantities for primarily the local markets in northwestern Alaska. A few sheefish are shipped to stores in Anchorage and Fairbanks. To date lack of adequate processing and cold storage facilities along with a very limited market has restricted expansion of the commercial fishery.

A slowly developing interest in taking sheefish for sport fishing is occurring. Sheefish are often difficult to land once hooked, especially the larger fish. The best sport fishing areas are located near Selawik after breakup in the spring and in the fall on the upper Kobuk River.

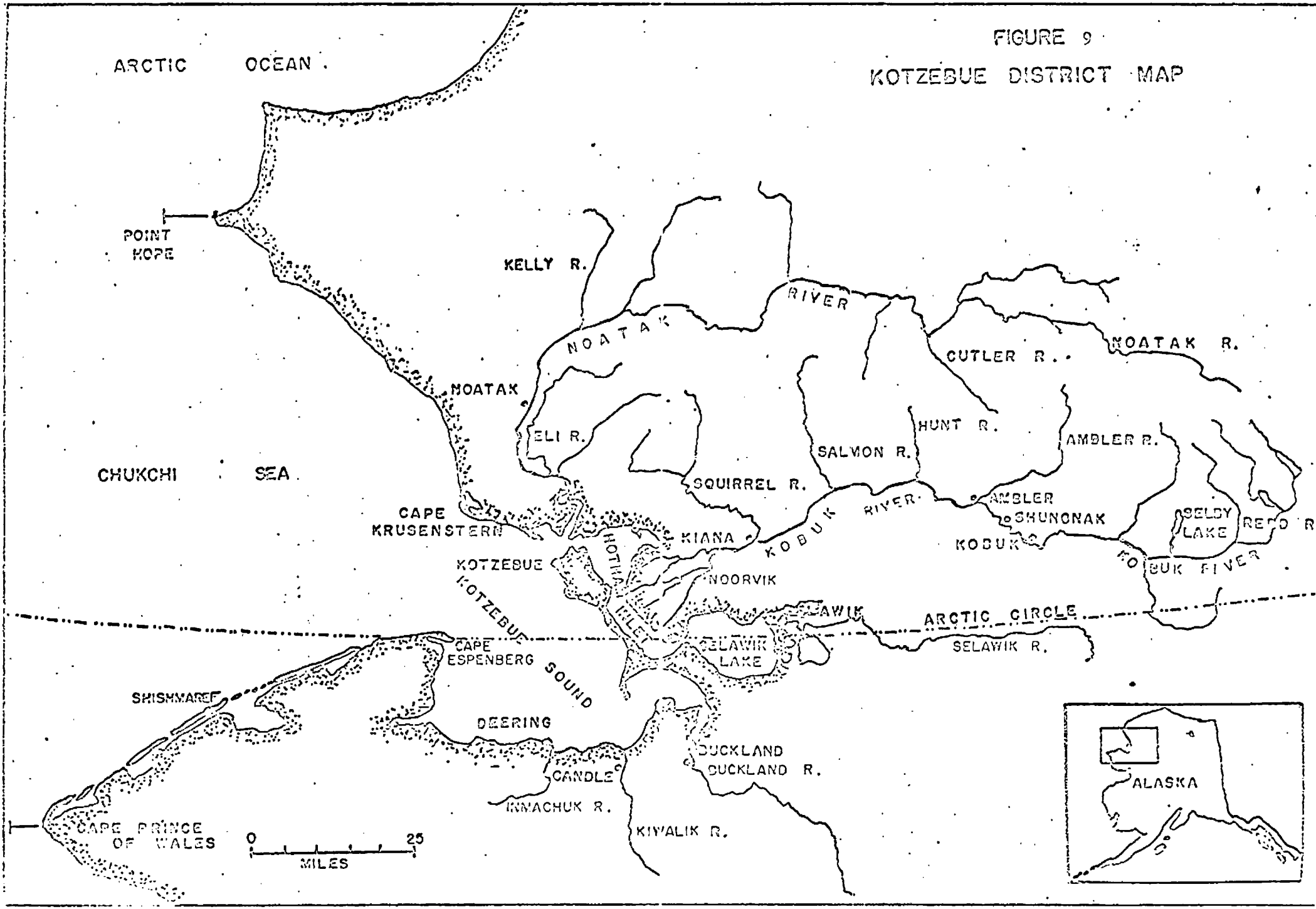


FIGURE 9
KOTZEBUE DISTRICT MAP
ARCTIC OCEAN
POINT HOPE
KELLY R.
NOATAK RIVER
NOATAK
NOATAK R.
CUTLER R.
ELI R.
HUNT R.
SALMON R.
AMBLER R.
CHUKCHI SEA
SQUIRREL R.
AMBLER
SHUNGNAK
SELDY LAKE
CAPE KRUSENSTERN
KIANA
KOBUK RIVER
KOBUK
KOTZEBUE
NOORVIK
KOTZEBUE SOUND
HOTHAM INLET
SELAWIK LAKE
SELAWIK
ARCTIC CIRCLE
SELAWIK R.
CAPE ESPENBERG
SHISHMAREF
DEERING
CANDLE
BUCKLAND
BUCKLAND R.
INMACHUK R.
KIVALIK R.
CAPE PRINCE OF WALES
0
25
MILES
ALASKA

OBJECTIVES

Basic life history studies of the Kotzebue sheefish populations and accurate records of the subsistence and commercial harvest are essential for proper management of the fishery. In order to develop sound management practices, biological investigations initiated in 1966 were continued in 1968 with emphasis on the following objectives:

1. Obtain accurate records of the subsistence and commercial harvest data.

2. Obtain age-sex-size composition and fecundity data.

3. Obtain estimates of spawning populations and observe spawning behavior, and in addition, ascertain if consecutive annual spawning occurs.

4. Determine movements of populations and seasonal abundance on a year-round basis.

METHODS AND MATERIALS

The following methods and materials were used in the Kotzebue sheefish studies:

1. Subsistence catch data was obtained primarily by personal interviews of fishing families in the following villages: Kotzebue, Selawik, Noorvik, Kiana, Ambler, Shungnak and Kobuk. Catch questionnaire forms were distributed to those fishermen not contacted. Records of commercial catches were obtained from fish tickets and personal interviews with fishermen and processors.

2. Age-sex-size composition data was collected by sampling the commercial, subsistence and Department test catches taken in Kotzebue Sound, Hotham Inlet, Selawik area and the Kobuk River. Lengths were measured from the tip of the snout to the fork of the tail in centimeters. Weight was recorded in pounds. Sex was determined by examination of the gonads when possible, or by external examinations of sexually mature fish on the spawning grounds. Sex could not be determined for sheefish caught in the winter or spring. Scale smears were taken in the area above the lateral line and between the dorsal and adipose fin and then placed in envelopes to be later mounted on glass microscope slides for age determination.

3. Fecundity information was collected from test catches (untagged fish) taken near the spawning grounds on the upper Kobuk River. Estimates of the fecundity of eight (8) female fish, selectively sampled over a wide size

range, were calculated by weighing a subsample count of 1,000 eggs compared to the total weight of both ovaries of each fish.

4. Aerial surveys of known spawning grounds of the Kobuk River were conducted using a small single engine aircraft (Supercub). An extensive reconnaissance aerial survey of the Selawik River was conducted for the first time.

5. Spawning ground observations were limited to recording daily air and water temperatures. Known spawning areas were marked and the depth of river and the type of streambed gravel were noted.

6. Movements and seasonal abundance of sheefish populations were determined by a tag and recovery program. Sheefish were captured for tagging with mainly set gill nets in the upper Kobuk River area and with drift gill nets in the Selawik area and, to a lesser extent, with rod and reel in both areas. Spaghetti tags (plastic tubing) individually numbered were inserted through the flesh in the vicinity of the dorsal fin. Notices, informing native fishermen of the tag and recovery program, were posted in each village. A reward of $1.00 was offered for each tag returned along with scale samples and the date and location of the tag recovery.

Assistance in planning and conducting some of the field studies was given by Mr. Ken Alt of the Division of Sport Fish. Also Mr. Dennis Kogl of the Division of Sport Fish assisted in the field projects.

RESULTS

Subsistence and Commercial Catches

In Table 37 Kotzebue Sound area subsistence and commercial catches for the Kobuk River villages, Kotzebue and Selawik are presented. Recorded catches are believed to represent approximately 90 percent of the actual harvest. Sheefish taken by both commercial and subsistence fishermen in the Selawik Lake and Hotham Inlet, Kotzebue Sound areas are mostly immature fish. The total subsistence catch during the period from the fall of 1967 to the fall of 1968 was 31,293 sheefish compared to the 1966-67 catch of 22,390. The greater subsistence catch during the 1967-68 season was due to an increased fishing effort by Kotzebue residents and also increased accuracy in the recording of subsistence catch data. On the other hand, Selawik and the Kobuk River subsistence catches experienced a decline mainly due to less intensive fishing effort. Very few sheefish were taken by upper Kobuk River residents during the fall due to an unexpected early freeze-up of the river.

TABLE 37

SUBSISTENCE AND COMMERCIAL SHEEFISH CATCHES
KOTZEBUE DISTRICT, 1967-1968

Village	Fishermen Interviewed	Number of Sheefish	
	SUBSISTENCE CATCH		
Noorvik	35	1,910	
Kiana	25	766	
Ambler	14	559	
Shungnak	13	837	
Kobuk	5	270	
Subtotal	92	4,342	(June, 1968-October, 1968)
Kotzebue	48	21,871	(October, 1967-July, 1968)
Selawik	38	5,080	(April, 1968-November, 1968)
TOTAL DISTRICT CATCH	178	31,293	
	COMMERCIAL CATCH		
Kotzebue	17	2,375	(October, 1967-September, 1968)

A total of 17 commercial fishermen harvested 2,375 sheefish (15,367 pounds) averaging approximately 6.5 pounds each. The commercial catch during the 1967-68 season was at least double that of the 1966-67 catch as a result of the establishment of a locally operated fishermen's cooperative in Kotzebue which provided an increased outlet for the catch.

Age-Sex-Size Composition Data

During the 1968 field season, the commercial Kotzebue catch and the upper Kobuk River spawning population was sampled for age, sex, size composition data. The Kotzebue commercial catch samples have not been analyzed to date. In Table 38 the upper Kobuk River sheefish age, sex and size composition data for 1968 is shown. Samples were collected near the spawning grounds and include both tagged and untagged fish which are sexually mature. A total of 469 sheefish was captured and approximately 88 percent were taken with set gill nets of 5-1/2, 6 and 6-1/2 inch mesh (stretched measure) while the remainder were taken with hook and line.

As noted in previous years (see 1967 Technical Report), hook and line gear is more selective toward capturing the more active male sheefish while gill nets tend to capture a greater proportion of females. In 1968 males appeared to be more abundant based on the larger number captured in gill nets. Males comprised 58.8 percent of the total sample. The average fork length for males was 77.0 cm while the average weight was 11.3 pounds. Males ranged in age from 7+ to 15+. Among males, the dominant age class was 9+ (27.5%) and 10+ (25.0%). The average fork length for females was 96.7 cm and the average weight was 27.1 pounds. Females ranged in age from 9+ to 21+. The most dominant age classes among females were 13+ (16.1%), 14+ (25.4%), 15+ (16.1%) and 16+ (14.0%).

In Table 39 the age and sex composition for upper Kobuk River sheefish sampled from the spawning areas is summarized for the year 1966-68. Due to the selectivity of the gear used (gill nets, beach seines and rod and reel) for sampling it is difficult to determine the actual sex ratio of the spawning run. In general, for males the age classes 8+, 9+ and 10+ were predominant during the three years. Males are capable of first becoming mature at age 7+. The oldest age male sheefish found was age 15+. Although males mature earlier than females, they do not live as long. Females are capable of first becoming mature at age 9+. The maximum age achieved by females observed to be 21+ years. In general, during the years 1966-68, the predominant age classes among females were 13+, 14+, 15+ and 16+ years.

Fecundity Relationship

In Table 40 the relation of the size of fish and the ovary weight to the number of eggs for Kobuk River sheefish is presented. As to be expected, there

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AGE, SEX AND SIZE COMPOSITION OF SPAWNING SHEEFISH
UPPER KOBUK RIVER, 1968

Age Class	MALES Number	Percent	Fork Length 1/	Weight 2/	FEMALES Number	Percent	Fork Length	Weight	COMBINED SEXES Number	Percent	Fork Length	Weight
7+	2	0.7	66.7	6.0					2	0.5	66.7	6.0
8+	24	8.7	68.8	7.5					24	5.1	68.8	7.5
9+	76	27.5	72.3	8.7	1	0.5	76.0	10.0	77	16.4	72.3	8.6
10+	69	25.0	74.0	9.8	4	2.1	85.0	18.3	73	15.6	74.6	10.2
11+	32	11.6	79.6	12.4	7	3.6	85.0	16.7	39	8.3	80.6	13.2
12+	18	6.5	85.0	15.2	11	5.7	90.7	20.6	29	6.2	87.2	17.3
13+	34	12.3	86.6	16.4	31	16.1	94.7	24.4	65	13.9	90.5	20.2
14+	15	5.4	86.1	16.3	49	25.4	95.5	25.7	64	13.7	93.3	23.5
15+	6	2.2	90.1	18.7	31	16.1	96.1	26.4	37	7.9	95.1	25.1
16+					27	14.0	99.0	29.4	27	5.8	99.0	29.4
17+					13	6.7	102.8	33.7	13	2.8	102.8	33.7
18+					9	4.7	106.2	37.5	9	1.9	106.2	37.5
19+					6	3.1	107.1	37.0	6	1.3	107.1	37.0
20+					3	1.6	110.2	43.0	3	0.6	110.2	43.0
21+					1	0.5	112.0	44.0	1	0.2	112.0	44.0
TOTAL	276	100.0	77.0	11.3	193	100.0	96.7	27.1	469	100.0	97.5	17.8

1/ Centimeters
2/ Pounds

TABLE 39

AGE COMPOSITION OF SPAWNING SH.. .ISH UPPER KOBUK RIVER, 1966-1968

Age Class	1966 MALES No.	1966 MALES %	1966 FEMALES No.	1966 FEMALES %	1966 COMBINED SEXES No.	1966 COMBINED SEXES %	1967 MALES No.	1967 MALES %	1967 FEMALES No.	1967 FEMALES %	1967 COMBINED SEXES No.	1967 COMBINED SEXES %	1968 MALES No.	1968 MALES %	1968 FEMALES No.	1968 FEMALES %	1968 COMBINED SEXES No.	1968 COMBINED SEXES %
7+	5	7.5			5	3.4	10	9.6			10	4.9	2	0.7			2	0.5
8+	19	28.4			19	12.8	22	21.2			22	10.8	24	8.7			24	5.1
9+	7	10.5	3	3.7	10	6.8	18	17.3	1	1.0	19	9.4	76	27.5	1	0.5	77	16.4
10+	10	14.9	7	8.6	17	11.5	12	11.5			12	5.9	69	25.0	4	2.1	73	15.6
11+	10	14.9	7	8.6	17	11.5	16	15.4	5	5.0	21	10.3	32	11.6	7	3.6	39	8.3
12+	11	16.4	10	12.4	21	14.2	14	13.5	7	7.1	21	10.3	18	6.5	11	5.7	29	6.2
13+	3	4.5	17	21.0	20	13.5	8	7.7	19	19.2	27	13.3	34	12.3	31	16.1	65	13.9
14+	2	3.0	14	17.3	16	10.8	4	3.8	29	29.3	33	16.3	15	5.4	49	25.4	64	13.7
15+			8	9.9	8	5.4			15	15.2	15	7.4	6	2.2	31	16.1	37	7.9
16+			3	3.7	3	2.0			8	8.1	8	3.9			27	14.0	27	5.8
17+			4	5.0	4	2.7			8	8.1	8	3.9			13	6.7	13	2.8
18+			4	5.0	4	2.7			4	4.0	4	2.0			9	4.7	9	1.9
19+			2	2.5	2	1.4			2	2.0	2	1.0			6	3.1	6	1.3
20+			1	1.2	1	0.7			1	1.0	1	0.5			3	1.6	3	0.6
21+			1	1.2	1	0.7									1	0.5	1	0.2
TOTAL	67	100.0	81	100.0	148	100.0	104	100.0	99	100.0	203	100.0	276	100.0	193	100.0	469	100.0

TABLE 40

RELATION OF SIZE OF FISH AND OVARY WEIGHT TO NUMBER OF EGGS
FOR KOBUK RIVER SHEEFISH, 1968

Sample Number	Age	Fork Length (cm)	Body Weight (lbs.)	Estimated No. of eggs	No. of eggs per pound of body weight	Ovary Weight (lbs.)	Percent Body Weight	No. of eggs per pound of ovary weight
1	9+	76.0	10.0	90,722	9,072	1.9	(19.0)	47,748
2	11+	78.6	14.0	124,868	8,919	2.1	(15.0)	59,461
3	12+	89.1	18.0	158,444	8,802	3.1	(17.2)	51,110
4	14+	94.5	23.0	174,766	7,599	4.1	(17.8)	42,626
5	13+	89.8	25.0	235,000	9,400	5.2	(20.8)	45,192
6	13+	105.6	33.5	310,381	9,265	7.2	(21.5)	43,108
7	17+	106.6	34.0	271,158	7,975	5.7	(16.8)	47,572
8	19+	117.1	47.0	459,381	9,774	9.8	(20.9)	46,876

was a definite trend toward an increase in fecundity as the size of fish increased. Fecundity ranged from 90,722 to 459,381 eggs per fish. Ages of the eight (8) fish selectively sampled for fecundity ranged from 9+ to 19+ years. The ovary weight of each fish accounted for, on the average, approximately 19 percent of the total body weight. The number of eggs per pound of body weight averaged 8,923.

Estimate of Spawning Population Size

In the fall of 1968, aerial surveys of sheefish schools distributed in the Kobuk and Selawik Rivers were conducted. In 1967 aerial survey methods appeared promising for obtaining an index of spawning population size. During 1968, aerial surveys were expanded considerably. The upper Kobuk River was surveyed from below Kalla to point 20 miles upstream from the mouth of the Selby River, a distance of approximately 50 miles. A total of 4,963 sheefish were observed in the Kobuk River, usually in the same locations observed in 1967.

For the first time the Selawik River was surveyed for concentrations of sheefish. An extensive survey was conducted covering a total distance of approximately 170 river miles. A total of 1,383 sheefish was observed.

The comparatively fewer numbers of sheefish observed in the Selawik River (1,383) versus a total of 4,973 sheefish in the Kobuk River was unexpected. Apparently the Kobuk River supports a substantially larger population of sheefish than the Selawik River. Based on the greater number of sheefish usually taken for subsistence annually by Selawik residents, it has been previously presumed that the Selawik River contained a larger spawning population than the Kobuk River. It appears that the Selawik residents are apparently harvesting moderate numbers of Kobuk River sheefish that spend a portion of the winter and spring in the Selawik Lake and Inland Lake areas, in addition to some Selawik River sheefish. This assumption has been more or less confirmed by results to date from our tag and recovery program conducted during the 1966-68 field seasons (see following section).

Seasonal Distribution and Movements

In order to determine the year-round movements of sheefish throughout the Kotzebue Sound area, a tag and recovery program was initiated in 1966 during late September on the upper Kobuk (upstream from the village of Kobuk: 26 miles) and has been expanded considerably each year. In early June, 1968, after breakup, a tag and recovery program was conducted in the Selawik area for the first time. The recovery distribution of tagged sheefish by recovery location for the years 1966-68 is summarized in Table 41.

During the years 1966-68 a total of 490 sheefish was tagged on the

TABLE 41

RECOVERY DISTRIBUTION OF SHEEFISH TAGGED AT UPPER KOBUK RIVER AND SELAWIK AREAS, 1966-1968

Year of Tagging	Number Tagged	Year of Recovery	Kobuk River	Selawik Area	Hotham Inlet	Kotzebue Sound	TOTAL RECOVERIES
			UPPER KOBUK RIVER TAGGING Recovery Area (Number and Percent)				
1966	40	1966	4(10.0)				4(10.0) 1/
		1967	5(12.5)	2(5.0)			7(17.5)
		1968	2(5.0)		2(5.0)		4(10.0)
		Subtotal	11(27.5)	2(5.0)	2(5.0)		15(37.5)
1967	116	1967	21(18.1)				21(18.1)
		1968	13(11.2)	4(3.4)	2(1.7)	1(0.9)	20(17.2)
		Subtotal	34(29.3)	4(3.4)	2(1.7)	1(0.9)	41(35.3)
1968	334	1968	87(26.0)				87(26.0)
TOTAL	490		132(26.9)	6(1.2)	4(0.8)	1(0.2)	143(29.2)
			SELAWIK AREA TAGGING				
1968	458	1968	24(5.2)	17(3.7)			41(9.0)

1/ Recovery Percentage in parenthesis.

upper Kobuk River spawning areas and 143 were recovered for an overall recovery rate of 29.2 percent. Most of the Kobuk River tagged fish were recovered either near the spawning grounds or during the upstream (spawning) or downstream (post-spawning) migrations. Of interest were the Kobuk River fish recovered in the Selawik area (6), Hotham Inlet (4), and Kotzebue Sound (1). These recoveries indicate that sheefish are probably widely dispersed in the saline-brackish waters of Selawik Lake, Hotham Inlet and to a lesser extent in Kotzebue Sound during the winter and spring. Detailed distribution of the Kobuk River sheefish tag recoveries by area for the years 1966-68 is shown in Appendix Tables K, L, and M.

A total of 458 sheefish were tagged and released in the Selawik area. Tagging operations were conducted at the Selawik River, Tuklomarak River, and Inland Lake areas. Since the sheefish at the Selawik area were tagged in early June, several months before the onset of spawning, it was not possible to determine externally the sex of each fish. The tagged sheefish ranged in weight from 2.0 to 40.5 pounds and averaged 16.2 pounds. The length (snout to fork of tail) ranged from 43.5 to 112.0 centimeters and averaged 83.5 centimeters. To date, a total of 41 recoveries (9.0%) have been made. Of particular interest is the significantly high proportion, 5.2 percent (24 recoveries, of tagged fish captured in the Kobuk River during the summer and fall of 1968 versus 3.7 percent (17 recoveries) taken in the Selawik area. Detailed distribution of the Selawik area tagged sheefish in 1968 by recovery area is presented in Table 42.

The tagging data, in conjunction with the aerial survey data previously discussed, strongly indicates that 1) the Kobuk River sheefish population is probably substantially larger than the Selawik River population and, 2) the Kobuk River sheefish are probably often located in the Selawik area during the winter and spring; and consequently, subject to being harvested by Selawik village subsistence fishermen.

Frequency of Consecutive Annual Spawning

Another prime objective of the tag and recovery program is to determine if sheefish are capable of consecutive annual spawning once sexual maturity is achieved. Recoveries of mature sheefish tagged in previous years on the spawning grounds and recaptured in subsequent years on the spawning areas would verify this assumption. In 1967 a recovery of a spawned-out male sheefish that was tagged on the Kobuk River spawning grounds in 1966 in the same area indicated that some male sheefish are presumably capable of spawning annually. In addition, two mature males that were tagged in 1967 on the Kobuk River spawning area were recaptured in 1968 in the same general area. Also, one male sheefish presumably bound for the upriver spawning areas was captured at Shungnak (41 miles downstream from the spawning grounds) on September 3, 1968. To date no female sheefish tagged in previous years have

TABLE 12

DAILY NUMBER OF SEEFISH TAGGED IN THE SELAWIK AREA AND NUMBER AND DATE OF RECOVERIES BY AREA, 1968

Tagging Date	Number Tagged	1968 Recoveries						Total Recoveries 1968
		Selawik Area	Upper Kobuk River Spawning Area	Kobuk	Shungnak	Ambler	Noorvik	
6/2	10				1(9/9)			1
6/3	69	3(7/25;10/9;11/10)					2(10/18;6/25)	5
6/4	44	2(6/15;10/10)	1(9/16)			2(8/10;9/3)		5
6/5	15							0
6/6	30	1(10/15)	1(9/24)					2
6/7	9	1(9/25)				1(9/14)		2
6/8	44	2(6/21;7/2)	1(9/15)					3
6/9	62		1(9/?)				1(6-7/?)	2
6/10	35	1(8/24)	2(9/24)		2(9/9,27)	1(9/1)		6
6/11	22	3(10/10,15;11/10)					2(6/25;8/24)	5
6/12	41						1(10/15)	1
6/13	45	2(8/20,30)	1(9/16)	1(9/12)			2(6/26;7/3)	6
6/14	22	2(6/24;10/22)						2
6/15	10						1(10/7)	1
TOTALS	458	17	7	1	3	4	9	41(9.0) 2/

1/ Recovery dates in parenthesis.
2/ Percentage recovery in parenthesis.

been recaptured subsequently on the spawning areas. However, it is noteworthy to mention that a female sheefish, tagged on the Kobuk River spawning grounds in 1967 (state of maturity unknown), was recaptured at Ambler (88 miles downstream from the spawning grounds) on August 14, 1968. It is possible that this fish was probably bound for the upper spawning areas.

Recoveries of sheefish, mostly males, tagged in 1967 and recovered during the fall or spring of 1968 in the lower portion of the Kobuk River were recorded. Whether or not these sheefish were bound for the upriver spawning areas in the spring or were migrating downstream in the fall following spawning is not known. Some immature sheefish migrate upstream in the lower portion of Kobuk River each year.

Since comparatively large numbers of sheefish (334) were tagged on the upper Kobuk River spawning grounds in 1968, it is expected that future recoveries of tagged sheefish on the spawning grounds in subsequent years will provide additional information on the frequency of consecutive annual spawning of sheefish.

Spawning Observations

In 1966 and 1967, spawning observations were conducted by the Department during late September on the upper Kobuk River, between 24 and 30 miles upstream of the village of Kobuk. These observations of spawning behavior suggest that sheefish utilized the specific areas having similar physical characteristics: water depths of 4 to 8 feet over differential size gravel in moderately swift current of the main river. Spawning occurs during the later afternoon-early evening hours. Also it was observed in 1966 and 1967 that sheefish eggs, which sink to the stream bottom and lodge in the interstices of the gravel, after being discharged by the female at the surface, are subject to apparently heavy predation by grayling and whitefish.

In 1968 spawning observations were not conducted due to an unprecedented early freezeup of the river. At the initiation of tagging studies on September 13, the water temperature was 45° F. On September 25, when the tagging operation was prematurely terminated, the water temperature had dropped to 31.5° F., a decline of 13.5° F. in 13 days. Sheefish spawning, as observed in 1966 and 1967, occurred mainly during the period September 27-29 and water temperatures ranged from 40-43° F. What effect the extremely cold water temperatures had on the success of sheefish spawning in 1968 is unknown. Although several portions of the upper Kobuk River were frozen over, it was observed during an aerial inspection of the river on September 29 that the major sheefish spawning areas were free of ice cover. It is speculated that sheefish spawning occurred at about the normal period of time in late September, although it may be possible that a slight delay in spawning may have occurred. It appears that annual timing of sheefish spawning in the

upper Kobuk River is probably more related to gonad development and timing, and to a much lesser extent, on water temperature.

DISCUSSION AND FUTURE PLANS

During the past three years (1966-1968) important information on the seasonal distribution and movements, spawning behavior, improved subsistence and commercial recording of catch data, fecundity relationship, and age, sex, and size composition of the spawning populations of sheefish have been obtained.

Future plans call for continuation of the tag and recovery projects in the upper Kobuk River and in the Selawik Lake-Island Lake area during 1969. Also an attempt will be made to tag sheefish on the upper Selawik River spawning grounds in late September in order to determine if the Selawik and Kobuk River sheefish runs are two distinct populations.

SUMMARY

1. During the 1967-68 season, a total of 31,293 sheefish was recorded as taken for subsistence in the Kotzebue district. Also a total of 2,375 sheefish was harvested commercially.

2. A total of 469 sheefish was sampled for age, sex and size composition data on the upper Kobuk River spawning areas in 1968. Males comprised 58.8 percent of the total sample. Males averaged 11.3 pounds while females average 27.1 pounds. The most dominant age classes among males were 9+ and 10+ years, while females were comprised of mainly 13+, 14+, 15+ and 16+ year old age classes. Additional comparisons for age and sex class compositions for the years 1966-68 were made for the upper Kobuk River sheefish samples.

3. A total of eight sheefish were selectively sampled over a wide size range in order to develop a fecundity-size relationship. Fecundity for the eight fish ranged from 90,722 to 459,381 estimated eggs per fish. The ovary weight accounted for approximately 19 percent of the total body weight and the number of eggs per pound of body weight averaged 8,923.

4. Aerial surveys of sheefish spawning areas were considerably expanded during the fall of 1968. A total of 4,973 sheefish was observed in the Kobuk River. In the Selawik River, which was surveyed for the first time, a total of 1,383 sheefish was observed. Based on these comparative aerial surveys, it appears that the Kobuk River is a much larger producer of sheefish than the Selawik River.

5. A total of 490 sheefish has been tagged on the upper Kobuk River during the fall of the years 1966-68 and 143 have been recovered (29.2%) to date. Although only relatively few recoveries have been made: Selawik area (6), Hotham Inlet (4) and Kotzebue Sound (1), it is indicated that sheefish are widely dispersed throughout these waters during the winter and spring months.

6. In the Selawik area, a tagging program was initiated in June of 1968 and a total of 458 sheefish was tagged and released. Of interest was the greater percentage (5.2%) recoveries made in the Kobuk River than in the Selawik Lake, Tuklomarak River and Inland Lake areas (3.7%). This data indicates that a relatively large proportion of Kobuk River sheefish are apparently orientated in the Selawik area during the winter and spring months.

7. In 1968, two mature male sheefish that were tagged in 1967 were recovered on the upper Kobuk River spawning areas. These recoveries indicate that some male sheefish are capable of consecutive annual spawning once sexual maturity is achieved.

8. Due to an unexpected early freezeup of the upper Kobuk River, sheefish spawning behavior observations were not conducted. Although water temperatures were unseasonally cold, near 32° F., it is speculated that sheefish spawning occurred at about the normal period of time (late September).

APPENDIX

APPENDIX TABLE A

NUMBERS OF YUKON RIVER KING SALMON
TAGGED, CAPTURED AND RECOVERED DURING 1968

Date	OHOGAMIUT SITE			DOGFISH VILLAGE SITE			PAIMIUT SITE		
	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch
6/4	0	0	0						
6/5	0	1	1						
6/6	0	1	1						
6/7	1	1	2						
6/8	0	0	0						
6/9	0	0	0	0	0	0			
6/10	1	1	2	0	0	0			
6/11	0	1	1	0	1	1			
6/12	0	0	0	0	0	0			
6/13	1	0	1	0	0	0			
6/14	1	5	6	0	0	0			
6/15	0	0	0	1	5	6			
6/16	4	5	9	5	7	12			
6/17	3	3	6	1	0	1			
6/18	0	3	3	3	5	8			
6/19	3	1	4	0	2	2			
6/20	4	4	8	1	3	4			
6/21	2	5	6	3	1	4			
6/22	4	5	9	6	11	17			
6/23	30	16	46	0	1	0			
6/24	94	74	168	0	1	1			
6/25	11	17	28	10	21	31			
6/26	3	7	10	5	7	12			

Date	COMBINED SITES			RECOVERIES OF TAGS OUT[1]			
	Numbers Tagged	Numbers Untagged	Total Catch	Ohogamiut	Dogfish Village	Paimiut	Total
6/4	0	0	0	0			0
6/5	0	1	1	0			0
6/6	0	1	1	0			0
6/7	1	1	2	1			1
6/8	0	0	0	0			0
6/9	0	0	0	0			1
6/10	1	1	2	0	0		0
6/11	0	2	2	0	0		0
6/12	0	0	0	0	0		0
6/13	1	0	1	1	0		1
6/14	1	5	6	1	0		1
6/15	1	5	6	0	0		0
6/16	9	12	21	3	2		5
6/17	4	3	7	2	1		3
6/18	3	8	11	0	1		1
6/19	3	3	6	2	0		2
6/20	5	7	12	3	1		4
6/21	5	6	11	1	2		3
6/22	10	16	26	2	2		4
6/23	30	16	46	10	0		10
6/24	94	75	169	27	0		27
6/25	21	38	59	2	3		5
6/26	8	14	22	3	0		3

APPENDIX TABLE A

NUMBERS OF YUKON RIVER KING SALMON
TAGGED, CAPTURED AND RECOVERED DURING 1968 (con't)

	OHOGAMIUT SITE			DOGFISH VILLAGE SITE			PAIMIUT SITE		
Date	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch
6/27	8	13	21	1	2	3			
6/28	20	32	52	0	2	2			
6/29	14	41	55				0	0	0
6/30	12	19	31				24	85	109
7/1	10	12	22				18	22	40
7/2	6	10	16				5	10	15
7/3	2	8	10				3	9	12
7/4	7	11	18				1	5	6
7/5	7	18	25				6	12	18
7/6	2	7	9				3	9	12
7/7	2	3	5				8	17	25
7/8	0	2	2				3	9	12
7/9	2	3	5				3	10	13
7/10	1	1	2				2	11	13
7/11	0	2	2				1	12	13
7/12	3	6	9				0	8	8
7/13	0	4	4						
7/14	2	0	2						
7/15	2	1	3						
7/16	1	1	2						
Totals	263	344	607	36	68	104	77	219	296

	COMBINED SITES			RECOVERIES OF TAGS OUT 1/			
Date	Numbers Tagged	Numbers Untagged	Total Catch	Ohogamiut	Dogfish Village	Paimiut	Total
6/27	9	15	24	2	0		2
6/28	20	34	54	4			4
6/29	14	41	55	1		0	1
6/30	36	104	140	5		2	7
7/1	28	34	62	2		4	6
7/2	11	20	31	0		0	0
7/3	5	17	22	1		1	2
7/4	8	16	24	1		0	1
7/5	13	30	43	1		0	1
7/6	5	16	21	0		1	1
7/7	10	20	30	1		0	1
7/8	3	11	14	0		2	2
7/9	5	13	18	0		0	0
7/10	3	12	15	0		0	0
7/11	1	14	15	0		0	0
7/12	3	14	17	0		0	0
7/13	0	4	4	0			0
7/14	2	0	2	0			0
7/15	2	1	3	0			0
7/16	1	1	2	0			0
Totals	376	631	1,007	76(28.9)	12(33.3)	10(13.0)	98(26.1)

1/ Figures in parenthesis represent recovery percentages of tags out.

APPENDIX TABLE B

NUMBERS OF YUKON RIVER CHUM SALMON
TAGGED, CAPTURED AND RECOVERED DURING 1968

Date	OHOGAMIUT SITE			DOGFISH VILLAGE SITE			PAIMIUT SITE		
	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch
6/4	0	0	0						
6/5	0	0	0						
	0	0	0						
	0	0	0						
6/8	0	0	0						
6/9	0	0	0	0	0	0			
6/10	0	0	0	0	0	0			
6/11	0	0	0	0	0	0			
6/12	0	0	0	0	0	0			
	1	0	0	0	0	0			
	2	0	2	0	0	0			
		4	5	0	0	0			
	3	5	8	0	1	1			
		3	4	0	0	0			
6/18	4	6	10	4	3	7			
6/19	0	5	5	2	3	5			
6/20	0	6	6	1	0	1			
6/21	5	7	12	4	8	12			
6/22	2	11	13	1	8	9			
6/23	1	11	12	0	3	3			
6/24	8	16	24	1	7	8			
		33	38	3	3	6			
		31	39	4	11	15			

Date	COMBINED SITES			RECOVERIES OF TAGS OUT 1/			
	Numbers Tagged	Numbers Untagged	Total Catch	Ohogamiut	Dogfish Village	Paimiut	Total
6/4	0	0	0	0			0
6/5	0	0	0	0			0
6/6	0	0	0	0			0
6/7	0	0	0	0			0
6/8	0	0	0	0			0
6/9	0	0	0	0	0		0
6/10	0	0	0	0	0		0
6/11	0	0	0	0	0		0
6/12	0	0	0	0	0		0
6/13	0	0	0	0	0		0
6/14	2	0	2	0	0		0
6/15	1	4	5	0	0		0
6/16	3	6	9	0	0		0
6/17	1	3	4	0	0		0
6/18	8	9	17	0	1		1
6/19	2	8	10	0	0		0
6/20	1	6	7	0	0		0
6/21	9	15	24	0	0		0
6/22	3	19	22	0	0		0
6/23	1	14	15	0	0		0
6/24	9	23	32	0	0		0
6/25	8	36	44	0	0		0
6/26	12	42	54	1	0		1

APPENDIX TABLE B

NUMBERS OF YUKON RIVER CHUM SALMON
TAGGED, CAPTURED AND RECOVERED DURING 1968 (con't)

	OHOGAMIUT SITE			DOGFISH VILLAGE SITE			PAIMIUT SITE		
Date	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch
6/27	10	48	58	0	4	4			
6/28	16	68	84	0	7	7			
6/29	18	66	84						
6/30	24	99	123				9	59	68
7/1	30	75	105				19	70	89
7/2	11	60	71				16	38	54
7/3	8	44	52				14	37	51
7/4	12	45	57				34	91	125
7/5	13	38	51				42	65	107
7/6	6	47	53				23	84	107
7/7	8	33	41				50	136	186
7/8	4	19	23				78	109	187
7/9	4	26	30				26	94	120
7/10	2	14	16				22	88	110
7/11	3	19	22				18	46	64
7/12	1	7	8				5	50	55
7/13	3	12	15						
7/14	1	8	9						
7/15	1	5	6						
7/16	0	8	8						
Totals	215	879	1,094	20	58	78	356	967	1,323

	COMBINED SITES			RECOVERIES OF TAGS OUT 1/			
Date	Numbers Tagged	Numbers Untagged	Total Catch	Ohogamiut	Dogfish Village	Paimiut	Total
6/27	10	52	62	0	0		0
6/28	16	75	91	2	0		2
6/29	18	66	84	2			2
6/30	33	158	191	1		0	1
7/1	49	145	194	4		3	7
7/2	27	98	125	2		2	4
7/3	22	81	103	0		3	3
7/4	46	136	182	3		1	4
7/5	55	103	158	1		6	7
7/6	29	131	160	0		2	2
7/7	58	169	227	1		1	2
7/8	82	128	210	1		5	6
7/9	30	120	150	1		0	1
7/10	24	102	126	0		1	1
7/11	21	65	86	0		1	1
7/12	6	57	63	0		0	0
7/13	3	12	15	0			0
7/14	1	8	9	0			0
7/15	1	5	6	0			0
7/16	0	8	8	0			0
Totals	591	1,904	2,495	19(8.8)	1(5.0)	25(7.0)	45(7.6)

1/ Figures in parenthesis represent recovery percentage of tags out.

APPENDIX TABLE C

KWINIUK RIVER DAILY SALMON ESCAPEMENTS, 1965-1968

Date	CHUMS				PINKS				KINGS			
	1965	1966	1967	1968	1965	1966	1967	1968	1965	1966	1967	1968
6/18	6											
6/19		24										
6/20		26										
6/21		108										
6/22		348										
6/23		253										
6/24		289										
6/25		-451*	5	66								
6/26		463	19	165								
6/27		129	53	835								
6/28	212	508	193	746	174			48			1	1
6/29	765	71	45	1,026	86			166	1	1		
6/30	1,593	412	1,140	671	-40*			320	1		3	1
7/1	869	3,548	693	934	56		1	221	1	1		1
7/2	4,296	1,891	591	1,528	38	11	2	575	3		1	
7/3	1,053	435	288	943	35	18	1	402	1			4
7/4	1,194	1,996	464	1,513	47	288	2	769			1	2
7/5	1,062	1,908	2,156	982	-8*	200		640				
7/6	1,028	1,226	510	838	2	16		1,636				
7/7	524	519	3,448	2,181	22	35	12	8,942		1		4
7/8	833	2,000	3,403	2,605	146	39	27	24,841			1	5
7/9	389	1,800	2,683	1,687	92	66	476	28,949	2	2	2	3
7/10	1,806	-31*	2,822	1,283	170	10	197	14,267			2	1
7/11	3,517	2,079	2,974	281	300	39	564	24,201	4			2
7/12	3,671	4,998	1,972	65	406	36	644	7,007	3		1	1
7/13	673	2,676	2,706	66	127	59	759	339	1		1	
7/14	2,953	354	308	16	1,203	81	453	-76*				
7/15	1,582	1,025	22	133	1,632	307	22	1,257	.1			1
7/16	4,164	-268*	37	26	2,813	-197*	70	514		-1*		
7/17	247	508	52	11	155	198	118	2,154		1		

APPENDIX TABLE C

KWINIUK RIVER DAILY SALMON ESCAPEMENTS, 1965-1968 (cont.)

Date	CHUMS 1965	1966	1967	1968	PINKS 1965	1966	1967	1968	KINGS 1965	1966	1967	1968
7/18	56	1,121	14	35	115	5[illegible]	32	4,220				
7/19	358	1,619	27	124	1,097	1,4[illegible]	26	3,118	1	1		
7/20		570	6	55		625	26	1,338				
7/21		244	50	32		296	135	1,240				
7/22		325	-20*	60		1,368	20	914				
7/23		215		44		1,219		464				
7/24		92		25		1,066		586				
7/25		107				2,172						
7/26		16				676						
7/27		31				107				1		
7/28		-2				66						
Total Tower Count:	32,861	33,182	26,661	18,976	8,668	10,864	3,587	129,052	19	7	13	27
Catch Above Tower by Subsistence Fishermen:	6,227	396	2,217	163	367	235	79	2,238	5	0	0	0
ESCAPEMENT:	26,634	32,786	24,444	18,813	8,301	10,629	3,508	126,764	14	7	13	27

* Fish moved downstream past tower

APPENDIX TABLE D

LENGTH FREQUENCIES BY AGE AND SEX OF YUKON RIVER KING SALMON, TEST FISHING (5-1/2" MESH GILL NETS), 1968

Length in cm.	4_2 Males	5_2 Males	5_2 Females	Length in cm.	6_2 Males	6_2 Females	7_2 Males	7_2 Females
54.0	2			76.0	1			
55.0				77.0		1		
56.0	1			78.0				
57.0	1			79.0	3	1		
58.0	2			80.0		2		
59.0	1			81.0	2			
60.0		1		82.0		2		
61.0				83.0	1	3		
62.0		1		84.0	2	4		
63.0				85.0	1	4		
64.0				86.0		5	1	
65.0				87.0	1	3		1
66.0				88.0	3	3		
67.0		1		89.0	3	6		2
68.0				90.0	6	3		
69.0			1	91.0	3	3		
70.0				92.0	4	2		1
71.0				93.0	4	4		
72.0				94.0	2	3		
73.0		1		95.0	3		1	2
74.0		3	1	96.0	2			2
75.0			1	97.0	2	2		2
76.0			1	98.0	1	1	1	1
77.0		1		99.0	4			1
78.0			1	100.0	2		2	1
				101.0			3	
				102.0				1
				103.0				
				104.0				
				105.0				
				106.0				
				107.0			1	
				108.0			1	
Number	7	8	5		50	52	10	14
Mean Length	56.6	70.1	74.6		90.7	87.8	99.3	95.1
		71.9			89.2		96.9	

APPENDIX TABLE E

KUSKOKWIM DISTRICT KING SALMON FECUNDITY, 1968

Species	Mideye Length[1/]	Weight[2/]	No. of eggs	Date Sampled
King Salmon				
Age 5_2	830	25.5	8,427	5/31
	830	23.1	12,275	6/14
Mean	830	24.3	10,351	
Age 6_2	754	15.2	8,525	6/10
	825	24.5	8,327	6/25
	835	21.0	10,058	6/4
	840	26.5	7,657	6/2
	846	26.4	10,109	6/24
	866	22.8	10,905	6/8
	870	28.0	8,065	5/31
	870	26.5	11,546	6/20
	892	22.5	11,265	6/27
	907	32.4	10,198	6/13
	928	32.6	12,795	6/9
	933	34.1	14,060	6/17
	939	38.5	14,427	6/11
	940	34.0	10,292	6/6
	954	33.0	11,942	6/10
	959	32.5	12,460	7/5
Mean	885	28.2	10,789	
Age 7_2	859	23.0	11,288	6/6
	925	32.0	10,224	5/31
	950	34.5	10,930	6/12
Mean	911	29.8	10,814	
Unknown Age	718	19.2	8,639	6/9
	950	37.0	12,741	6/4
Mean	834	28.1	10,690	
Mean - All Ages	879	28.0	10,746	

1/ In millimeters.
2/ In pounds.

APPENDIX TABLE F

AGE-SEX-SIZE COMPOSITION OF QUINHAGAK CHUM SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	MALES Percent	MALES Mean[1/] Length	MALES Mean[2/] Weight	FEMALES No.	FEMALES Percent	FEMALES Mean Length	FEMALES Mean Weight	COMBINED SEXES No.	COMBINED SEXES Percent	COMBINED SEXES Mean Length	COMBINED SEXES Mean Weight
3_1	2	1.0	51.8	5.7	1	0.5	53.7	5.5	3	1.5	52.5	5.6
4_1	68	35.3	60.5	8.4	88	45.6	57.8	6.8	156	80.9	59.0	7.5
5_1	21	10.9	64.2	10.4	12	6.2	60.8	8.0	33	17.1	63.0	9.5
6_1	1	0.5	65.7	11.3	—	—	—	—	1	0.5	65.7	11.3
Totals	92	47.7	61.9	8.8	101	52.3	58.1	7.0	193	100.0	59.6	7.9

APPENDIX TABLE G

AGE SEX SIZE COMPOSITION OF QUINHAGAK PINK SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	MALES Percent	MALES Mean[1/] Length	MALES Mean[2/] Weight	FEMALES No.	FEMALES Percent	FEMALES Mean Length	FEMALES Mean Weight	COMBINED SEXES No.	COMBINED SEXES Percent	COMBINED SEXES Mean Length	COMBINED SEXES Mean Weight
2_1	84	87.5	46.9	4.1	12	12.5	45.1	3.6	96	100.0	46.7	4.0

1/ In centimeters.
2/ In pounds.

APPENDIX TABLE J

KUSKOKWIM DISTRICT RED AND CHUM SALMON FECUNDITY, 1968

Species	Mideye Length[1]	Weight[2]	No. of eggs	Date Sampled
Red Salmon				
Age 4_2	516	6.1	4,723	6/18
	523	6.0	3,932	6/23
Mean	520	6.1	4,328	
Age 5_2	550	6.2	3,103	6/19
	570	6.2	2,565	6/17
Mean	560	6.2	2,834	
Age 5_3	600	8.2	4,200	6/26
Mean	600	8.2	4,200	
Age 6_3	594	8.5	4,487	6/21
Mean	594	8.5	4,487	
Mean - All Ages	559	6.9	3,820	
Chum Salmon				
Age 4_1	544	6.2	2,105	6/23
	551	6.2	3,228	6/11
	558	6.7	1,956	6/12
	559	7.0	3,539	7/3
	565	7.2	2,202	6/26
	565	7.2	3,245	7/5
	572	7.8	4,295	7/3
	574	6.5	2,421	6/13
	582	6.4	2,663	6/7
	589	7.5	2,346	6/24
	590	7.5	3,210	6/29
	597	7.5	3,016	6/14
	600	7.1	2,456	6/18
	601	8.2	3,301	6/25
	605	8.0	4,191	6/19
	621	9.5	3,360	6/27
Mean	580	7.3	2,971	
Age 5_1	543	6.1	4,139	7/4
	592	9.0	2,597	6/4
	604	7.5	2,982	6/21
	610	8.5	2,889	6/15
Mean	587	7.8	3,152	
Mean - All Ages	581	7.4	3,007	

1/ In millimeters.
2/ In pounds.

APPENDIX TA

DAILY NUMBER OF SHEEFISH TAGGED ON UPPER KOBUK RIVER SPAWNING AREA 1966
AND NUMBER AND DATE OF RECOVERIES BY AREA 1966-1968[1]

Tagging Date	Number Tagged	1966 TAG — 1966 Recoveries: Upper Kobuk R. Spawning Area	Noorvik	Kiana	Total Recoveries 1966	1967 Recoveries: Upper Kobuk R. Spawning Area	Noorvik	Selawik Area	Recoveries 1967	1968 Recoveries: Noorvik	Hotham Inlet	Total Recoveries 1968	TOTAL RECOVERIES '66,'67,'68
9/17	4						1(6/5)	1(5/5)	2	1(10/16)		1	3
9/18	5										1(9/29)	1	1
9/19	2						1(6/16)		1				1
9/20	0												
9/21	9						2(6/15,17)		2		1(9/5)	1	3
9/22	9	2(9/26,27)	1(12/15)	1(10/4)	4	1(9/30)			1	1(8/9)		1	6
9/23	2												
9/24	5												
9/25	1							1(5/14)	1				1
9/26	1												
9/27	0												
9/28	2												
TAL	40	2	1	1	4(10.0) 2/	1	4	2	7(17.5) 2/	2	2	4(10.0) 2/	15(37.5) 2/

1/ Recovery dates in parenthesis

2/ Percentage recovery in parenthesis

APPENDIX TABLE H

AGE-SEX-SIZE COMPOSITION OF QUINHAGAK RED SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	Percent	Mean[1/] Length	Mean[2/] Weight	FEMALES No.	Percent	Mean Length	Mean Weight	COMBINED SEXES No.	Percent	Mean Length	Mean Weight
4_2	70	39.5	54.7	6.5	67	37.9	52.1	5.2	137	77.4	53.4	5.8
5_2	21	11.9	59.4	8.2	11	6.2	58.0	7.3	32	18.1	58.9	7.9
5_3	3	1.7	52.5	5.7	2	1.1	52.2	5.0	5	2.8	52.4	5.4
6_2	1	0.6	61.0	10.5	0	-	-	-	1	0.6	61.0	10.5
6_3	0	-	-	-	2	1.1	59.8	7.9	2	1.1	59.8	7.9
Totals	95	53.7	55.7	6.9	82	46.3	53.1	5.5	177	100.0	54.4	6.2

APPENDIX TABLE I

AGE-SEX-SIZE COMPOSITION OF LOWER KUSKOKWIM RIVER COHO SALMON, COMMERCIAL FISHERY, 1968

Age	MALES No.	Percent	Mean[1/] Length	Mean[1/] Weight	FEMALES No.	Percent	Mean Length	Mean Weight	COMBINED SEXES No.	Percent	Mean Length	Mean Weight
3_2	2	1.3	52.8	5.8	1	0.6	53.0	5.0	3	1.9	52.8	5.5
4_2	76	47.2	56.8	7.5	82	50.9	56.0	6.8	158	98.1	56.4	7.1
Totals	78	48.5	56.7	7.4	83	51.5	56.0	6.8	161	100.0	56.3	7.1

1/ In centimeters.
2/ In pounds.

APPENDIX TABLE L

DAILY NUMBER OF SHEEFISH TAGGED ON UPPER KOBUK RIVER SPAWNING AREA IN 1967 AND NUMBER AND DATE OF RECOVERIES BY AREA, 1967-1968[1/]

Tagging Date	Number Tagged	1967 TAGGING — 1967 Recoveries						Total Recoveries 1967
		Upper Kobuk R. Spawning Area	Kobuk	Shungnak	Ambler	Kiana	Noorvik	
9/13	7			1(10/6)			1(9/9)	2
9/14	20	1(9/24)		2(9/15,30)		1(10/9)		4
9/15	9						1(9/30)	1
9/16	5	3(9/21,17,21)	1(9/27)					4
9/17	10							
9/18	12				1(9/30)			1
9/19	7			1(9/27)			1(10/3)	2
9/20	11	1(9/28)			2(10,4,7)			3
9/21	10			1(10/3)				1
9/22	3							
9/23	7	1(9/27)					1(9/20-30)	2
9/24	3							
9/25	4							
9/26	5	1(9/28)						1
9/27	2							
9/28								
9/29	1							
TOTALS	116	7	1	5	3	1	4	21(18.1)[2/]

APPENDIX TABLE L

DAILY NUMBER OF SHEEFISH TAGGED ON UPPER KOBUK RIVER SPAWNING AREA IN 1967 AND NUMBER AND DATE OF RECOVERIES BY AREA, 1967-1968[1/] (con't)

	1967 TAGGING										
	1967 Recoveries										
Number Tagged	Kotzebue Sound	Hotham Inlet	Selawik Area	Upper Kobuk R. Spawning Area	Shungnak	Ambler	Kiana	Noorvik	Mouth of Kobuk R.	Total Recoveries 1968	TOTAL RECOVERIES 1967 & 1968
7				1(9/24)				1(6-8/?)		2	4
20								1(10/18)		1	5
9			1(6/6)	1(9/24)				1(6/13)		3	4
5											4
10							2(8/9;9/10)			2	2
12			1(9/6)						1(6/15)	2	3
7								1(10/9)		1	3
11		1(11/?)			1(9/3)					2	5
10									1(6/20-30)	1	2
3			1(6/9)							1	1
7								1(10/9)		1	3
3		1(8/1)								1	1
4						1(8/14)				1	1
5	1(7/21)		1(8/30)							2	3
2											
1											
116	1	2	4	2	1	1	2	5	2	20(17.2)[2/]	41(35.3)[2/]

1/ Recovery dates in parenthesis
2/ Percentage recovery in parenthesis

APPENDIX TABLE M

DAILY NUMBER OF SHEEFISH TAGGED ON UPPER KOBUK RIVER SPAWNING AREA AND NUMBER AND DATE OF RECOVERIES BY AREA, 1968[1/]

Tagging Date	Number Tagged	1968 TAGGING — 1968 Recoveries					Total Recoveries 1968
		Upper Kobuk River Spawning Area	Shungnak	Ambler	Kiana	Noorvik	
9/13	28	5(9/24,14,24,20,24)	1(9/25)	1(10/21)		3(10/11,17,22)	10
9/14	23	2(9/15,23)		1(9/24)		3(9/20,26,27)	6
9/15	37	6(9/16,17,16,21,23,25)	2(9/23;10/19)	4(9/23,25;10/10,30)	2(9/23;10/24)	2(10/5,7)	16
9/16	28	2(9/20,24)		2(10/14,15)		2(10/15)	6
9/17	29	4(9/21,24,23,24)		1(10/5)		3(10/15,11,15)	8
9/18	21	3(9/20,23,20)		1(10/7)		1(10/20)	5
9/19	14	1(9/20)					1
9/20	18	3(9/21,23,24)				2(10/15)	5
9/21	18	3(9/23,25,23)	1(10/13)	1(10/5)			5
9/22	26	5(9/23)		1(10/16)		1(10/21)	7
9/23	35	1(9/25)	1(10/11)		2(11/6,20)	1(10/15)	5
9/24	24		1(10/8)	2(10/9;11/1)	1(10/14)	2(10/15,22)	6
9/25	33		2(10/16,26)	3(10/16,28;11/4)	1(10/21)	1(10/15)	7
TOTALS	334	35	8	15	6	21	87(26.0)[2/]

1/ Recovery dates in parenthesis
2/ Percentage recovery in parenthesis.